MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

1888 AND 1889.

WITH TWO APPENDICES.

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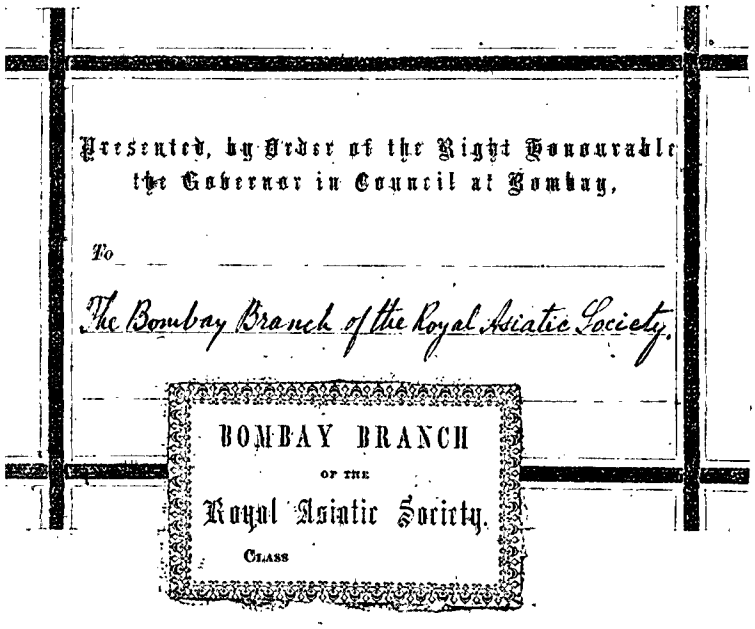

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1888 AND 1889.

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WITH TWO APPENDICES.

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS

MADE AT THE

GOVERNMENT OBSERVATORY, BOMBAY,

IN THE YEARS 1888 AND 1889

UNDER THE DIRECTION OF

133499

CHARLES CHAMBERS, Esq., F.R.S.

AND

FREDERICK CHAMBERS, Esq.,

TOGETHER WITH APPENDICES CONTAINING ACCOUNTS OF MAGNETIC RESEARCHES.

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TABLE OF CONTENTS.

PAGE

INTRODUCTION TO THE METEOROLOGICAL AND MAGNETICAL OBSERVATIONS, 1888 AND 1889.

Twenty-ninth number of the series ... ... i.
Geographical position of Observatory ... ... id.
Local situation ... ... id.
Directorship of the Observatory ... ... id.
Observatory Establishment ... ... id.
System of observation and reduction and distribution of duties ... ... ii.
Eye-observations subsidiary to continuous registrations of automatic instruments ... iii.
Instruments and phenomena observed five times a day ... ... id.
Other routine operations ... ... iv.

REMARKS ON THE CONDITION AND ADJUSTMENTS OF THE INSTRUMENTS AND ON THE PROCESSES OF REDUCTION ... ... id.

I.—METEOROLOGICAL INSTRUMENTS, 1888 AND 1889.

BAROMETER, description of ... ... v.
Error in setting the zero point of the scale, and change of method of observation ... id.
Corrections applied to the observed readings ... ... vi.
Comparison with the Kew Standard Barometer ... ... id.

GROUND THERMOMETERS ... ... vii.
THE ROBINSON-BECKLEY ANEMOGRAPH, description of... ... ... id.
Tabulation of Anemograms ... ... viii.
Method of reduction ... ... ix.
NEWMAN'S RAIN GAUGE ... ... id.
BAROGRAPH AND THERMOGRAPH ... ... x.

PRESSURE OF VAPOUR.

Pressure of Vapour and additional capacity of the Air ... ... id.
Table I.—Regnault's values of the Pressure of Vapour at different Temperatures ... xi.

SELF-REGISTERING RAIN GAUGE ... ... id.
New syphon of modified form ... ... id.
Constants for converting syphon discharges into inches of rain-fall ... ... id.
Measurement and distribution of syphon discharges ... ... xii.
Determination of scale of rain-fall ordinates ... ... id.

DESCRIPTION OF THE TABLES OF METEOROLOGICAL RESULTS AND OF THE PROCESSES OF REDUCTION, 1888 AND 1889.

Barometric Pressure ... ... id.
Temperature of the Air, &c. ... ... xiii.
Monthly and annual range of variation of Meteorological Elements ... ... id.

NOTES ON INSTRUMENTAL CHANGES AND ON ALL IRREGULARITIES OR DEPARTURES FROM THE ROUTINE OF OBSERVATION OR REDUCTION, 1888 AND 1889.

Robinson-Beckley Anemograph ... ... id.
Barograph ... ... xiv.
Thermograph dry-bulb ... ... id.
Thermograph wet-bulb ... ... id.
Self-registering Rain Gauge ... ... xv.

II.—MAGNETICAL INSTRUMENTS, 1888 AND 1889.

Kew Absolute Declinometer and Deflection and Vibration Apparatus ... ... id.
Kew Dip Circle ... ... id.

Tables of Results derived from the Continuous Registrations of Automatic Meteorological Instruments and from Meteorological Observations, 1888 and 1889.

		1888.		1889.	
		Table.	Page.	Table.	Page.
Daily Means of	Barometric Pressure	I	2	IX	11
	Temperature of the Air	II	3	X	12
	Pressure of Vapour	III	4	XI	13
	Additional Capacity of the Air	IV	5	XII	14
	Individual observations in each Month of the Year, which showed the greatest and the least values of the following elements, *viz.*, Height of Barometer, corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air ...	XXI	24	XXII	24
Daily.	Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground	V	6	XIII	15
	Mean Velocities of the North or South and East or West Components of the Winds which blew on each Day of the Year ..	VI	7	XIV	16
	Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew for each day of Bombay Civil Time; also the Mean Monthly Velocity, and its Variation from the Mean of the Year	VII	8	XV	17
	Sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several months, and of different Winds during the same month ...	VIII	9	XVI	18

Tables of Results derived from the Meteorological Observations made daily at 6, 10, 14, 16 and 22 hours, 1888 and 1889.

		1888.		1889.	
		Table.	Page.	Table.	Page.
	Monthly Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface	XXIII	25	XXIV	25
	Extent of Cloudy Sky—mean of estimations made at 6, 10, 14, 16 and 22 hours daily, the whole sky being reckoned as 10 ...	XVII	20	XIX	22
Daily.	Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground	XVIII	21	XX	23
	Five-Day Means, 1888 and 1889...	XXV	26	XXVI	27

Tables of Results of Absolute Magnetical Observations, 1888 and 1889.

	1888.		1889.	
	Table.	Page.	Table.	Page.
Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliot Brothers), for the determination of Absolute Horizontal Force	I	(3)	IV	(13)
Observations of Absolute Declination	II	(6)	V	(16)
Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles	III	(7)	VI	(17)
Supplementary Observations of Inclination, taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles...	IIIa	(10)	VIa	(20)

Trial Observations of Inclination taken with Barrow's Dip Circle, with Microscopes No. 49—during the intervals between times when it was being taken to pieces, cleaned and re-adjusted—and with several 3½-inch Needles ... ... Table VIb, Page (23).

Appendices I and II.

INTRODUCTION

TO THE

METEOROLOGICAL AND MAGNETICAL OBSERVATIONS,

1888 AND 1889.

Of the series of books entitled "Bombay Magnetical and Meteorological Observations" the present one is the twenty-ninth, extending the record, which before embraced the years 1845 to 1887, up to 1889.

2. The latitude and longitude of the Colába Observatory are 18° 53′ 45″ North and 72° 48′ 56″ East respectively.

3. *Local situation.*—The Observatory is situated at the extremity of a narrow strip of land extending two miles to the south-westward of the Fort of Bombay and separating the harbour and Back Bay. Trap rock, which is very abundant in the ground near and on the surrounding sea-beach, crops up at many places through the red sandy soil which covers the greater part of the Observatory enclosure. During the rainy months of the year, the soil is overgrown with grass, which, however, is quickly burned up when the dry season comes round. The nearest elevated ground is Malabár Hill, which lies on the opposite side of Back Bay, at a distance of four miles, but that which subtends the largest vertical angle, as seen from the Magnetical and Meteorological Observatory, is the southern hill of the Island of Karanja, at a distance of about eight miles across the harbour. The altitude of the highest point of the latter is less than 1° 7′. An idea of the aspect and nature of the surrounding country, and of the exposure of the thermometer shed and anemograph, may be obtained by inspection of the photographs—forming a series of panoramic views all round the compass, together with some near views of the buildings and instruments—which accompanied the "Meteorology of the Bombay Presidency" published in 1878. In the same work will be found a plan of the grounds and buildings of the Observatory, and an index showing the names and uses of the several buildings, and the location of trees of large and small growth.

The buildings concerned with the production of the observations recorded herein are, (1) the Astronomical Observatory and the Anemometer Tower, with a western wing, the greater part of which serves as a computing room, whilst the remainder is partitioned off for a photographic operating room; (2) the Magnetical Observatory with the adjoining Electrometer Tower; (3) the underground Magnetograph room; and (4) the Thermograph Shed, enclosing the thermograph room; to which may be added the old thermometer shed.

4. *Directorship of the Observatory.*—The observations of the years 1888 and 1889 were taken under the direction of Mr. Charles Chambers, F.R.S., except during the period August 22 to November 21, 1888, when the acting Directorship was held by Mr. Frederick Chambers.

5. *Observatory Establishment.*—In the Magnetical Department of the Observatory there are one First Assistant, one Second Assistant, three Observers and one Computer; and in the Astronomical Department one First Assistant

and one Second Assistant. These several offices were filled, during the years 1888 and 1889, in the manner exhibited in the following statement:—

Name of Officer.	Department.	Name of Office.	Period.		Initial.
			From	To	
Vinayek Narayen Nene	Magnetical ...	First Assistant ...	1st January 1888 ...	31st December 1889 .	V. N.
Crishnaji Ganesh Thakur... ...	Do. ...	Second Assistant .	Do. ...	Do. ...	C.
Ganesh Sadashiv Joshi	Do. ...	Observer	Do. ...	Do. ...	G. S. J.
Narayen Sakharam Kelker ...	Do. ...	Do.	31st March 1888 ...	Do. ...	N.
Damodar Waman Sathaye ...	Do. ...	Do.	1st January 1888 ...	Do. ...	D.
Govind Narayen Vadak	Do. ...	Computer... ...	3rd January 1888...	15th February 1888 .	G.
	Do. ...	Observer	16th February 1888 .	30th March 1888.	
	Do. ...	Computer... ...	31st March 1888 ...	18th April 1888.	
Shitaram Vithal Bendarker ...	Do. ...	Do.	18th October 1889 ...	31st December 1889.	S.
Hari Chintaman Karkhanis ...	Astronomical ...	First Assistant ...	1st January 1888 ...	15th February 1888 .	H. C.
Parsharam Laxuman Datar ...	Do. ...	Second Assistant .	Do. ...	Do. ...	P.
	Do. ...	First Assistant ...	16th February 1888 .	31st December 1889.	
Vithal Govind Ghaneker... ...	Magnetical ...	Observer	1st January 1888 ...	15th February 1888	V. G. G.
	Astronomical ...	Second Assistant .	16th February 1888 .	31st December 1889.	

The initials marked in the last column are those which the respective observers attach to the several observations made by them.

Govind Narayen Vadak was absent on leave on 1st and 2nd January 1888 and from 19th April 1888 to 17th October 1889, and then he resigned: his duties were performed on all occasions by Shitaram Vithal Bendarker.

Mr. Hari Chintaman Karkhanis retired on pension from the office of First Assistant of the Astronomical Department of the Observatory on the 16th February, 1888.

6. *System of observation and reduction and distribution of duties.*—The Astronomical Observatory is furnished with a transit instrument and a sidereal clock, which are used for the determination of local time, primarily for communication to the shipping in the Bombay harbour, and secondarily for communication, by comparison of chronometers three times a week, to the Magnetical and Meteorological Observatory.

Magnetical and meteorological observations are taken and entered in the registration forms every day, without exception, at the hours 6, 10, 14, 16, and 22,—the day commencing at midnight at Bombay (Colába) and being reckoned from 0^h to 24^h. One observer (called the morning observer) takes the 6^h observation, a second one (the day observer) those of 10^h, 14^h and 16^h, a third one (the night observer) that of 22^h, and a fourth is relieved from observing duty for one week; the next week the four observers change round in circular order, and so on week by week. On Sundays and general holidays special arrangements are made to set free all but three members of the staff—one being kept on observing duty, one in charge of photographic instruments, and one in charge of the Astronomical Observatory. All the observers reside on the premises, and they are required to keep a general out-look on the weather during the intervals between their respective hours of observing duty and the next earlier observation hours. Each observer reduces his own observation immediately after the entry of the observation in the register, and the reductions are checked by the observer who next comes on duty: amongst the duties of the day observer are included the calculation of daily averages, and the writing out of the monthly abstracts. These latter consist of tables having the days of the month marked in numerical order in the first column and the hours of the day in order at the head of the columns, and there is one for each magnetical or meteorological element observed. Attendance in the computing room is exacted of the observers, when not actually engaged upon observing duty, as well as of the First Assistant, Magnetical Department, Second Assistant, Astronomical Department, and Computer, for six hours daily, exclusive of a break for rest in the middle of

the day. Upon the First Assistant devolves the immediate oversight of general observing, computing and photographic operations. The observations of absolute declination, horizontal intensity, and dip, which are repeated once, twice and four times respectively every week, are distributed amongst the more experienced observers in such a manner that no two consecutive weeks' observations should, as a rule, fall to the same observer. The time of one Assistant is almost entirely absorbed by the photographic operations, the instruments requiring vigilant attention, and the chemical processes demanding much skill and care.

The anemograph is in charge of the Second Assistant, Astronomical Department, who changes the recording paper daily, and tabulates the hourly readings of direction and movement of the wind. The tabulations are checked by the Photographer, between whom and the Second Assistant, Astronomical Department, are divided also the resolution of the tabulations into components and the writing out and checking of wind abstracts, the one performing a set of operations and the other checking them, and so on alternately. The correspondence of the direction record to the actual direction of the vane is frequently checked by turning the instrument to point to the Kennery Lighthouse, the azimuth of which is accurately known. In order to preserve the direction gear in smooth working condition, the fixed toothed wheel is cleaned and oiled—without stopping the instrument—once a week; and every day the direction vane is turned right round the compass once each way, with the object of lubricating both sides of the teeth of the wheel.

All computing operations are systematically performed by one computer and checked, by a repetition of the operation, by another.

7. The eye-observations that are taken five times a day are subsidiary to continuous registrations obtained by means of automatic recording instruments. Of these there are five sets of apparatus,

I. The magnetographs,
II. The barograph,
III. The thermograph,
IV. The pluviograph, and
V. The anemograph,

of which IV is an appendage of III, designed to work with the same light and to trace its curve on the same sheet of sensitive paper. The first four register photographically and the last mechanically.

8. *Instruments and phenomena observed five times a day.*—These are as follows:—

Extent and description of clouds, state of the weather, occasional phenomena, and direction of the wind.	From 5 minutes before to 2 minutes after the exact hour.
Thermograph standard thermometer, dry bulb Do. do. wet bulb	At 2 minutes after the exact hour.
Newman's rain gauge (in wet season)... ...	„ 3 „ „
Thermometer in ground 1 inch deep... ... Do. do. 9 inches deep ...	From 5 to 7 „
Newman's standard barometer No. 58 and attached thermometer. Do. do. No. 48 ditto.	„ 7 to 9 „
Grubb's declination magnetometer	At 12 „ „
Grubb's horizontal force magnetometer and its thermometer	„ 14 „ „
Vertical force magnetograph and its thermometer...	„ 17 „ „

Declination magnetograph ...	...	...	At 18 minutes after the exact hour.
Horizontal force magnetograph and its thermometer	...	„ 19	„ „
Thermometer attached to barograph	...	„ 20	„ „

The vacuum gauges of the magnetographs are read at 10 hours only, the maximum and minimum thermometers in the magnetograph room are read and re-set at 10 hours only, and the 20 inches, 60 inches and 132 inches deep ground thermometers are read at 14 hours only.

Newman's rain gauge is read daily at midnight in the wet season, and the discharges of the syphon of the self-registering rain gauge are read once a day or oftener as required.

9. *Other routine operations.*—(1) The anemograph is supplied with fresh recording papers daily.

(2) Fresh sensitive papers are put upon the recording cylinders of the three magnetographs, of the barograph, and of the thermograph and pluviograph every two days. The papers taken off are developed, fixed and washed, and new ones are prepared by the photographer on alternate days.

(3) The tabulation of anemograms is effected as soon as the papers are available, generally, that is, on the day following that to which the record refers. Barograms, thermograms and horizontal force magnetograms also are regularly tabulated as soon as the registers are available.

(4) Double sets of observations of vibration and deflection are made with the unifilar magnetometer for the determination of the absolute horizontal force weekly, and with the same instrument observations of absolute declination are also made weekly.

Observations of magnetic dip are made four times a week.

The times of vibration of Grubb's declination and Grubb's horizontal force magnetometers are observed once a year; but each of the magnets is disturbed through a large arc (yet less than 1°) once a month, and the nearness of its return to the undisturbed position is recorded.

(5) Transit observations of stars for the determination of time are made generally on Mondays, Wednesdays and Fridays in the dry months: during the monsoon no opportunity is lost of observing the sun or stars when visible. The adjustment of the transit instrument is frequently tested by reference to the fixed collimator mark; the collimation, level, and azimuthal errors are determined from time to time, and whenever the collimator shows a displacement of the telescope, or any considerable discordances appear in the clock errors derived from observations of stars of different north polar distances.

Remarks on the Condition and Adjustments of the Instruments and on the Processes of Reduction.

10. The object of the following description is to make known such special circumstances in connection with the condition, situation and adjustment of the instruments, with the habits of the observers, and with the routine of the processes of reduction, as are necessary to enable the reader to form an independent judgment of the degree of precision attained, and of the weight to be attached to any conclusions that may be drawn from the observations.

I.—METEOROLOGICAL INSTRUMENTS, 1888 and 1889.

Barometer.

11. *Description.*—The observations which furnished the fundamental data for the construction of the tables of barometric pressure for the years 1888 and 1889 were taken with a standard barometer by Newman, marked No. 58, the same which has been used uninterruptedly since the establishment of the Observatory. The internal diameter of the barometer tube, marked by the maker on the frame of the instrument, is 0·530 inch. The scale, which is of brass, is moveable, and terminates below in an ivory point which is designed to be set, at each observation, so as just to touch the surface of the mercury in the cistern, and the setting is known to be accurate when the point appears just to meet its image reflected from the mercury. The upper part of the scale, which is divided to twentieths of an inch, has a vernier with slow motion screw, reading to thousandths of an inch, and to it are attached two small brass plates with horizontal lower edges before and behind the tube: the setting of the instrument consists in raising and lowering the vernier until the horizontal plane containing these two edges is tangent to the surface of the mercury in the tube of the barometer, and this is the case when it is just so low, and no lower, that when the eye is raised or lowered no light is seen to pass between the central part of the mercurial surface and the two edges. A thermometer with a cylindrical bulb dipping into the mercury in the cistern is attached to the barometer, and is intended to be read at every observation: but an investigation described in the "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xlii to xlv, showed that the errors of this thermometer—as measuring the temperature of the mercurial column—were considerable, and since the end of 1884 its use has been discontinued: in lieu of it a thermometer by Murray and Heath (No. 2) divided to half degrees, and with its bulb immersed in a column of mercury held in a glass tube of nearly the same diameter as that of the barometer, was fixed on one side of the metal frame of the barometer at about the same height as the middle of the barometric column, and this has been regularly observed since 1885·0. The error of the new thermometer varies by about a quarter of a degree within the annual range of the temperature of the barometer No. 58, and in adopting a mean error throughout small pressure corrections of $\pm$·0003 are disregarded.

The standard barometer is attached by means of brackets to a flat board which hangs against the wall on the eastern side of the Magnetical Observatory, near the north-east corner of the room, and its cistern has an elevation of 37 feet above the mean sea level at Colába. It was lifted down in May 1866 and the mercury carefully caused to run up to the top of the tube, where it gave the sharp metallic stroke that is indicative of a good vacuum. It is stated in the "Report of the Committee of Physics of the Royal Society, 1840," page 56, where a description is given of a class of barometers of which this is an individual, that the scale is laid off from the zero point from an authentic standard. The tube of the barometer is kept in proper adjustment to verticality.

12. *Error in setting the zero point of the scale, and change of method of observation.*—In the long period that has elapsed since the instrument was mounted (in 1841) there has been a gradual accumulation of scum on the surface of the mercury in the cistern, and the glass cistern became more and more opaque until the reflected image of the ivory zero point of the scale was very obscurely seen, so that the operation of setting the zero of the scale was uncertain to a very sensible degree. For this reason, the method of observation which had always previously been in accordance with the above description, was changed on the 22nd May 1866, so as to avoid the necessity of setting the scale at every observation. The scale was set once for all on that day and the setting

screw then removed; and suitable corrections were thereafter applied for the rise and fall of the mercury in the cistern. These were taken from a table calculated by the formula*

$$\text{Capacity correction} = \cdot 04321\ (h_0 - 29\cdot 943)$$

where h_0 represents the uncorrected reading of the barometer. As the departure of the barometer reading from its mean value very rarely reaches 0·4 inch, which would require a correction of only ·017 inch, it is very improbable that an error of so much as ·001 inch ever occurs from inaccuracy in the adopted value of the relative capacities of the tube and cistern. Since the change was made, the comparability of the observations for showing variations is, therefore, throughout much better secured.

13. *Corrections applied to the observed readings.*—It was stated in the instructions given in the Report of the Committee of Physics (page 56) that the correction for capillary action in barometers of this description is rendered inappreciable by the large diameter of the tube, and consequently no correction for capillarity has ever been applied. Besides the correction for capacity, two others only have been applied; one, invariably from the first, for reducing the observations to what they would have been if the temperature of the mercury had always been 32° Fahr. and that of the brass scale 62° Fahr., and the other, since 1885·0, to remove the discontinuity that would otherwise have been produced in the records by the change of thermometers: the first was taken from Table II. of the Committee's Report, and the last was a constant reduction of the corrected pressure by ·002 inch. The considerations on which the latter correction was based are as follows: (1) the tabulations of the barograph are known to exhibit correctly the diurnal variations of barometric pressure, free from any sensible influence of variations of the temperature of that instrument;† (2) the mean of twenty-four hourly barograph tabulations on any day is taken to correspond to the mean of the same twenty-four hourly pressures observed with Newman's barometer No. 58 and corrected for the temperatures indicated by the old attached thermometer; (3) it does not follow that the mean of the tabulations for the five observation hours (6, 10, 14, 16 and 22) will then correspond exactly to the mean of the observed pressures for the same hours, because the old thermometer does not indicate precisely the actual variations of temperature of the mercurial column: in fact the latter mean pressure was, on the average of all the observation days of the year 1872, ·0008 inch in excess of the former mean pressure; (4) nevertheless the correspondence for the five observation hours was adopted as near enough to identity with the correspondence for the twenty-four hours, and the recorded mean pressures of the years 1873 to 1884 will thus be ·0008 inch in excess of those of the years before 1873; (5) the old attached thermometer and the thermometer No. 2 by Murray and Heath were read together at the five observation hours throughout the year 1883, and the average excess of the former reading over the latter was found to be 0°·62; (6) hence to make the pressures reduced for the readings of Murray and Heath No. 2 correspond to those reduced for the readings of the old thermometer the former pressures must be decreased by $\cdot 0027 \times 0\cdot 62 = \cdot 0017$, or—as the pressures are read and calculated only to thousandths of an inch—by ·002 inch. Thus taking the period before 1873·0 as a standard period, the recorded annual mean pressures of the years 1873 to 1884 will be ·0008 inch too high, and those of 1885 and later years ·0005 inch [$= -\cdot 0020 + \cdot 0017 + \cdot 0008$] too high.

14. *Comparison with the Kew Standard Barometer.*—Indirect comparisons of Newman's barometer No. 58 with the Kew standard have been made through

* The data for the construction of this formula will be found in the "Bombay Magnetical and Meteorological Observations, 1865–70," Introduction, pp. x, xi.

† *See* "Bombay Magnetical and Meteorological Observations, 1871-78," Introduction, pages xxxvii to xlvi.

the mediation of two mountain barometers by Negretti and Zambra, numbered 705 and 711 : in Bombay these were both found (in July 1876) to read ·011 inch higher than Newman No. 58, whilst in England they had been found to be ·007 and ·006 inch respectively above the Kew standard: hence Newman's No. 58 reads on the average ·004 inch below the Kew standard. It happens that this is exactly the average amount by which the readings of Newman's barometer have been over-reduced for temperature (*see* Introduction to volume for 1871 to 1878, paragraph 72).

Ground Thermometers.

15. Thermometers with their bulbs at the respective depths below the surface of the ground of 1, 9, 20, 60, and 132 inches are regularly observed, the two former five times a day and the three latter once a day at 14 hours. They are all by Newman, of London, and are divided on brass scales, and the value of one division, approximate range of part of scale exposed above ground, and lengths of that part and of one average degree are shown below for each thermometer :—

Depth of Bulb.	Divided to	Approximate Range of exposed part of Scale.	Length of that Range.	Average length of 1°.
Inch.			Inches.	Inch.
1	1°	30° to 145°	8·19	·071
9	0°·2	70° to 115°	5·20	·116
20	1°	35° to 160°	6·73	·054
60	1°	35° to 160°	6·81	·054
132	1°	50° to 140°	6·44	·072

The 1-inch and 9-inch thermometers are on flat brass scale frames, which lie against wooden posts in the ground, and they have their bulbs in contact with the loose red earth which fills the holes in which they are placed ; the 20-inch, 60-inch, and 132-inch thermometers have their lower parts enclosed in brass tubes with ends curving off to a point, and the upper parts are in wooden box frames, to which the brass scales are fixed. The reason why only one observation is made daily of the three deeper thermometers is, that it had been found by hourly observations in 1849, 1850 and 1851, that no appreciable diurnal variation of temperature reached the depth of 20 inches.

The errors of graduation of the ground thermometers are unknown.

The Robinson-Beckley Anemograph.

16 *Description.*—From the beginning of the month of June 1867 was brought into use an anemograph of the kind designed by Dr. Robinson, with improvements by Mr. Robert Beckley, and it remains in action to this day. It was made by Mr. R. W. Munro, and was supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory. In this instrument the arrangements for the registration both of movement and direction of the wind are mounted on one shaft, and the registrations are made on a single sheet of paper, which is changed daily. The essential part of the apparatus for measuring the movement is a vertical spindle, to which cross arms are attached at the top, carrying four hemispherical cups of copper. The cups are attached to their several arms, so that, looking from the central axis, their convex sides are seen turned to the right hand, and the wind, acting with

greater effect upon the concave than on the convex sides of the cups, causes the system to rotate in a right-handed direction. It is the number of these rotations, 140 of which are reckoned to a mile of movement of the wind, that tells us how fast the wind has been blowing; and the number is reduced, by means of wheel-work, 7,000 times before reaching a small cylinder, carrying a brass spiral pencil that traces the movement on the registering paper; this latter is metallic paper of the kind used for pocket-books, and is wrapped round a brass cylinder, which is kept rotating by clockwork, and as the paper passes under the spiral pencil, which presses slightly upon it, the black movement trace is received upon it. The wind vane, which consists of a pair of windmill vanes with connecting spindle having an endless screw in the middle, and gearing into a fixed horizontal toothed wheel, is attached to a tube that surrounds the lower part of the vertical movement spindle; to the bottom of the tube is fixed a toothed wheel, which, in communication with other such wheels, conveys the motion of the vane *unchanged* to a small cylinder with spiral pencil, which traces the changes of direction on the register; and it is so arranged that the movement and direction are traced on parallel strips or bands of the same sheet of paper. The heavy parts of the instrument—the direction vane and appendages, and two long brass tubes which connect the instrument proper with the recording apparatus—are supported on friction balls which run in grooves partially filled with oil, thus reducing the friction to a minimum. The instrument is erected on the old Time Ball Tower, at a height of 53 feet above the ground, and 95 feet above the mean sea level, over a platform 12 feet in diameter, which is designed to give ready access to the instrument, and to protect it from irregular currents of wind, glancing from the convex surface of the dome; and it is supported outside by a fixed cast-iron standard, to which is attached, at the top, the toothed wheel, into which the endless screw of the spindle connecting the windmill vanes gears. The centres of each pair of opposite hemispherical cups are four feet apart, and three and a half feet above the platform, and the diameter of the cups is nine inches. The diameter of the vanes is 15 inches, and the breadth of the fans four inches. The register form is printed in red, with lines dividing its length into hour spaces; and its breadth, on the movement side, into five spaces, each representing 10 miles of movement of the wind, and numbered from 0 to 50 miles; and on the direction side into spaces corresponding to 11¼ degrees on each side of the 16 principal directions N.N.E., N.E., &c.....N.N.W., N., which spaces are numbered consecutively 1, 2, &c..... .15, 16.*

17. *Tabulation of Anemograms.*—Numerical tabulations have been made of the movement and direction of the wind during the interval between every two successive hours in the following manner:—the number of miles indicated at the point where the velocity trace cuts a horizontal hour-line being read for two successive hours, the excess of the latter over the former reading (adding 50 if the trace has passed over from left to right of the form) gives the movement for the interval; and the number of the space in which the direction trace lies during the interval is entered as representing the direction. The estimations of movement are made only to the nearest full mile. Should the direction trace not lie all in one space during the whole interval of an hour, then if the change of direction exceed 90° or eight points, the whole observation for that hourly interval is rejected; but if it lie within that limit, the direction is estimated—by an inspection of the movement and direction traces together—whence the aggregate flow of air was the greatest, and this direction is adopted for the full hour. On the average of the years 1871 to 1883, out of 8,754 hours during which the instrument was in action, 3 only had to be rejected, because the direction of the wind varied more than eight points within the hour.

* A more detailed account of the Colába anemograph will be found in the "Bombay Magnetical and Meteorological Observations, 1865 to 1870," Appendix I., page 199.

18. *Method of reduction.*—Hitherto we have had to speak of phenomena liable only to simple increase and decrease of value, and not subject to any change of quality. Such phenomena being properly and completely evaluated by simple numbers, we may apply to the numbers any arithmetical operations, such as averaging, and infer from the results of those operations corresponding properties of the phenomena. But we have now come to a phenomenon which requires two numbers to express it, one representing its amount and the other a varying quality; the first referring to the velocity, and the last to the direction of the wind. Here we may no longer apply arithmetical processes directly and indiscriminately to the observed numbers: but, the subject being one of motion, we must treat them according to the principles of the science of motion. These principles tell us that the motions may be equally well expressed by means of two varying numbers referring to two invariable qualities, as by a varying number referring to a varying quality; and they show us how to obtain either form of expression from the other. The invariable qualities chosen in the present case are the directions north and east, the actual wind blowing in each hour being resolved into north and east components, which may be regarded separately as the velocity of the wind in the invariable direction north or south, and the velocity of the wind in the invariable direction east or west. The resolutions are effected by means of the formulæ:—

$$\text{North component of velocity of wind} = m \cos (n \times 22\tfrac{1}{2}^\circ),$$
$$\text{East component of velocity of wind} = m \sin (n \times 22\tfrac{1}{2}^\circ),$$

where m is the movement observed, and n the number of the direction space under which the wind of the hourly interval is classed. When the sign of either of these calculated quantities is negative, it implies that the wind blows from the opposite direction, *i. e.* from south or west. The calculations are readily made by means of tables to the nearest tenth of a mile of velocity per hour. Having now substituted the two equivalent winds for the real one, we may with propriety proceed to combine together numbers of observations by algebraical addition and averaging, treating the north and east components of the wind each by themselves. The averages thus found from the observations of any given period will represent the velocity with which the wind must blow from the northward (from the southward if the sign of the average be negative) continuously for the whole period, in order that the total movement of the wind from that direction may be the same as the total movement from the same direction produced by the winds which actually blow, and similarly the velocity with which it must blow continuously from the eastward (westward if the sign of the average be negative).

No corrections have been applied to the anemograph tabulations on account of friction.

Rain Gauge.

19. *Newman's Rain Gauge.*—This instrument is made of copper, and exposes for the collection of rain-drops a circular surface of an average diameter of 12·035 inches, forming the top of a funnel, that carries the rain into a cylindrical vessel below, having a diameter of 5·732 inches: a float of slightly less diameter, so as to rise and fall freely, rests upon the water in this vessel, and having a wholly convex external surface, it allows the rain as it falls to flow off and raise the level of the water and with it the float; to the middle of the float is fixed a wooden rod, graduated with divisions, each of which represents ·05 inch of rain; and the readings of this scale, which are easily estimated to fifths of a division, are made where it is cut by the upper edge of a light brass rod placed horizontally across the mouth of the funnel, but half an inch below the edge of the exposed circular surface; the scale passes through a hole in the middle of the horizontal rod, and is thus kept always in a vertical position.

The range of the scale is from 0 to 4·00 inches, and the readings of the scale have been entered in the meteorological register and the differences been taken for every interval between successive observations: the rain has accumulated in the vessel generally till the reading was somewhere above 2·00 inches, when the water was let out, by means of a brass cock at the bottom, till the reading came down to 0·00 inch. This latter reading was also maintained during intervals of dry weather—when, from evaporation, the scale would otherwise have fallen lower—by pouring small quantities of water into the gauge: the reason of this is obvious, as, if some water were not always retained, the float would sometimes rest on the bottom of the vessel and so cease to perform its function of rising equally for equal increments of rain. The scale on the wooden rod was graduated so as to agree approximately with the data—the diameters of the gauge and measuring vessel—given above. The error of the scale according to which the rod was graduated was less than a thousandth of the whole.

Newman's gauge stands on a large rectangular block of stone, in a position intermediate between the Entrance Gate, the Magnetical Observatory, and the Thermograph Shed, where the altitude of the highest neighbouring object, as seen from the gauge, is about 30°. It is supported by three feet, which are embedded with lead in holes cut in the stone block, and its circular mouth is at a height of 4½ feet above the ground and about 35 feet above the mean sea level.

Barograph and Thermograph.

20. Like the anemograph, the Colába barograph and thermograph were supplied through the Kew Committee of the British Association, after being tested at the Kew Observatory; and they are of like construction with those adopted by the Meteorological Committee of the Royal Society for the seven observatories established by them in the year 1867 in the United Kingdom. An account of these instruments in general, with notes on the peculiarities of the Colába set and on special points in the Colába arrangement of them and utilization of their registrations, will be found in the 1871—78 volume of this series, Introduction, pages xvi to xlvi.

21. *Thermograph.*—The height of the bulbs of the thermometers above the ground is 10 feet. The cage is placed on one of the most exposed parts of the Observatory grounds and away from any building: it is, however, screened, as well as the thermograph room in which the recording apparatus is placed, by a roomy shed with a planked roof that is everywhere 2 feet above the roofs of the cage and room: the sides of the shed are of the louvre construction on an enlarged scale, with double sheets of zinc enclosing a thick layer of felt substituted for the wooden laths, and with a vertical distance from lath to lath of one foot: the lowermost two feet of the sides are guarded simply by horizontal iron rods: the roof of the shed is covered with thick felt and then with strong canvas, and the whole of the exterior—sides and roof—is painted white.

Pressure of Vapour.

22. *Pressure of Vapour and additional capacity of the Air.*—Having obtained from the tabulations of the barograms and thermograms hourly values of barometric pressure, temperature of the air, and temperature of evaporation, the pressure of vapour was calculated for each hour with the aid of a table by the formula

$$f''=f'-\cdot01147\ (t-t')\times\tfrac{p-f'}{30}$$

in which t and t' denote the temperatures of the air and wet bulb thermometers respectively, f'' and f' the pressure of vapour at the temperature of the dew point

and at temperature t', and P the barometric pressure. The values of the pressure of vapour at different temperatures were taken from the following table, the numbers in which have been extracted from Boileau's Collection of Tables:—

TABLE 1.—*Regnault's values of the Pressure of Vapour at different Temperatures.*

Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.	Temperature.	Pressure of vapour.
o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.	o	Inch.
35	·204	43	·278	51	·374	59	·500	67	·662	75	·868	83	1·128	91	1·455
36	·212	44	·288	52	·388	60	·518	68	·685	76	·897	84	1·165	92	1·501
37	·220	45	·299	53	·403	61	·537	69	·709	77	·927	85	1·203	93	1·548
38	·229	46	·311	54	·418	62	·556	70	·733	78	·958	86	1·242	94	1·597
39	·238	47	·323	55	·433	63	·576	71	·758	79	·990	87	1·282	95	1·647
40	·248	48	·335	56	·449	64	·596	72	·784	80	1·023	88	1·324	96	1·698
41	·257	49	·348	57	·466	65	·617	73	·811	81	1·057	89	1·366	97	1·751
42	·267	50	·361	58	·482	66	·639	74	·839	82	1·092	90	1·410	98	1·805

To find the additional capacity of the air the pressure of vapour was deducted from the number in the above table standing opposite to the temperature of the air.

SELF-REGISTERING RAIN GAUGE.

23. A description of this instrument also will be found in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1871 to 1878," page xlvi. In 1888 and 1889 the syphon discharges were received in glass bottles and measured by means of a graduated glass tube and a marked glass bottle holding exactly half an inch of rain.

24. It was mentioned in former years that the occurrence of the discharging action of the syphon was occasionally liable to some uncertainty—the water at times trickling over the bend of the tube in considerable quantities before the proper discharge commenced. After trial of many modifications in the form of the syphon one was at last hit upon, which is free from this fault, and by which the tube is, moreover, kept in a satisfactorily clean condition from beginning to end of the monsoon, simply by the washing that takes place in the ordinary automatic discharges. Since November 1884, when the new syphon was brought into use, the discharges have been regular and unfailing.

25. To prevent birds alighting upon the funnel, and choking it with their droppings, a conical arrangement of pointed iron spikes surrounding the funnel was attached in 1882, and was found to be effective.

26. *Constants for converting syphon discharges into inches of rainfall.*—As the surface exposed by the rain gauge funnel is 50·286 square inches, an inch of rain contains 823·955 cubic centimeters. With the aid of a cubic centimeter measure,* 412 cubic centimeters of water were poured into a narrow-necked glass bottle, and a file mark was made on the bottle neck at the level up to which the water rose. A glass tube was also graduated by means of the same cubic centimeter measure, so as to read off thousandths of an inch of rain with ease. The bottle is filled as often as there have been discharges from the rain gauge syphon, and the final excess or defect is measured with the graduated tube. The use of the bottle began on 31st July 1879 and continued till the 26th July 1884, when it was accidentally broken. An exact copy of it, which had been prepared beforehand, was then substituted for the original bottle, and this copy is still in use.

* Lent by Mr. F. Chambers, whose verification data show it to be accurate to a thousandth of the 100 cubic centimeters which it is designed to measure.

27. *Measurement and distribution of syphon discharges.*—The discharges are measured daily, or oftener during heavy rainfall, and are of course always of an integral number. For each measurement the average value of a discharge is attributed to each of the intervals of time, shown on the rain curve, between pairs of successive discharges; and it remains then only to distribute this quantity, for each filling of the receiving vessel, by means of tabulations of the ordinates of the rain curve. When, as is often the case, the rate of fall of the rain at the time of a discharge exceeds $1\frac{1}{8}$ inch per hour, it is necessary to allow for the rain that enters the receiving vessel during the known time (16 seconds) of discharge, the allowance depending on the rate of rainfall, which is easily estimated for this purpose by noting, with the aid of an appropriate paper scale, the inclination of the rain curve immediately after the time of discharge. The aggregate of such allowances is deducted from a day's (or other) measurement before dividing the quantity equally amongst the several intervals.

28. *Determination of scale of rainfall ordinates.*—The factor for converting ordinates of the rainfall curve into inches of rainfall was found by experiments in which a determined weight or volume of distilled water was poured into the receiving vessel, and the change of length of the ordinate produced thereby was carefully measured. In an experiment made on the 12th July, 1888, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·477 of a true inch; whence the factor is found to be 1·006, which is applicable to all the rainfall registrations of the year 1888. In a similar experiment made on the 18th June 1889, the quantity of water poured into the vessel was equivalent to ·480 inch of rain, and the change of length of the ordinate ·480 of a true inch; whence the factor is found to be 1·000, which is applicable to all the rainfall registrations of the year 1889.

29. The tabulations are made with the true-inch scale of the thermograph tabulating instrument, using the white line as datum; and the reading of this datum that shall correspond to the reading ·000 of the rain curve, when the receiving vessel has just been discharged, is re-determined whenever the adjustment of the recording apparatus is disturbed. For this purpose an average is taken of a number of measurements for all of which the rain is falling very slowly at the time of the syphon's coming into action and for a short time longer. It is necessary to select such occasions, because at times of heavy rainfall the curve has risen sensibly before the light has had time to make a distinct impression on the sensitive paper. The mode of tabulating is (1) to set the scale on the constant reading corresponding to the white line, (2) to move the sliding piece until the index is set upon the white line, and (3) to move the sliding bar till the index is set upon the curve, and then read the scale. By setting the paper carefully, so that a considerable length of the white line is practically parallel to the lateral motion of the frame, the repetition of the first two operations of tabulation is avoided until many hourly ordinates have been read; and then a new setting of the paper is made for another stretch of the white line.

Description of the Tables of Meteorological Results and of the Processes of Reduction, 1888 and 1889.

30. *Barometric Pressure.*—In Tables I and IX are shown, for every day in the year, the mean of 24 hourly tabulations of the barograph, corrected* to agree with Newman's barometer No. 58;—also the mean pressure for each month and each year, and the excess of each monthly mean above the annual mean for

* In the manner described in paragraph 54 of the Introduction of the "Bombay Magnetical and Meteorological Observations for 1871 to 1878."

the same year; and the principal features of the annual variation are indicated at the foot of each of the tables. The maximum and minimum daily pressures in each month are distinguished by being printed in strong figures.

31. *Temperature of the Air, &c.*—The plan of the following tables is the same as that of Table I, but the subjects of them and the sources from which the numbers are obtained and the mode of obtaining them are as stated below:—

Tables II and X.—Temperature of the air: derived from hourly tabulations of the thermograph dry-bulb.

Tables III and XI.—Pressure of vapour: derived from hourly tabulations of the thermograph dry-bulb and wet-bulb, and of the barograph; and calculated in the manner described in paragraph 22.

Tables IV and XII.—Additional capacity of the air: derived from hourly differences between the pressure of vapour corresponding to the temperature of the air and the calculated actual pressure of vapour.

Tables VI and XIV.—Velocities of the north and east components of the wind: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Tables VII and XV.—Velocity of the wind regardless of direction: derived from hourly tabulations from the register of the Robinson-Beckley anemograph.

Tables XVII and XIX.—Extent of cloudy sky: derived from estimations made at the hours 6, 10, 14, 16, and 22 daily.

32. Tables V, XIII, XVIII and XX are on the same plan as Table I, except that the entries made in them are aggregates—daily, monthly and yearly—instead of mean values; and they are sufficiently explained by their several headings.

33. *Monthly and annual range of variation of Meteorological Elements.*—Tables XXI and XXII show the extreme limits between which the oscillations of barometric pressure, temperature of the air, pressure of vapour, and additional capacity of the air were confined in each month and in the whole year, and also the ranges of the respective oscillations.

34. The numbers in Tables VIII and XVI are derived from hourly tabulations from the register of the Robinson-Beckley anemograph. The temperatures of the ground given in Tables XXIII and XXIV are derived from the readings of the several thermometers made five times a day as regards the 1 inch and 9 inches deep thermometers, and once a day as regards the 20 inches, 60 inches and 132 inches deep thermometers. The five-day means of Tables XXV and XXVI are derived from hourly tabulations of the barograph (combined with readings of Newman's barometer No. 58) and thermograph, from the measurements in Newman's rain-gauge, and from hourly tabulations from the register of the Robinson-Beckley anemograph. In other respects these tables require no explanation beyond their titles, headings of the several columns, and the foot-notes.

Notes on instrumental changes and on all irregularities or departures from the routine of observation or reduction, 1888 and 1889.

35. *Robinson-Beckley Anemograph.*—Clock stopped on May 5 and 7, 1888, an insect having got crushed on the escapement wheel. String of driving weight of clock broke on September 3, 1888, and July 21, 1889. External parts painted on May 28, 1888, and June 1 and December 2, 1889. Dismounted and cleaned on November 22, 1889. The aggregate of all the interruptions of the instrument

in the years 1888 and 1889 was $11^h\ 45^m$: the loss of record was, however, rarely complete, and values partly or entirely interpolated have been inserted whenever the interruption was not somewhat prolonged. To aid in the making of interpolations, it has been customary, whenever the action of the instrument was voluntarily interrupted for more than one hour, to observe the direction of the wind by estimation, and to record the readings of a small auxiliary velocity measurer put up for the occasion. No complete day's records have been omitted in the formation of monthly abstracts.

36. When for any reason the traces furnished by the photographic self-registering instruments are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses.

37. *Barograph.*—No tabulations were obtained for the following hours for the several reasons stated, but eye-observations were available, and were adopted for the hours marked within parentheses, and for the rest interpolation had to be resorted to:—

(1) Owing to stoppage of clock: for 1888 June $9^d\ 0^h$ and 1^h.

(2) Paper cylinder having been clamped by an occasional operator too loosely to the driving wheel: for 1888 August $22^d\ 9^h$ and (10^h).

The aggregate of all the interruptions of the barograph in the years 1888 and 1889 was $3^h\ 14^m$*, and the number of hourly tabulations lost was 4, but of these 1 was substituted by an eye-observation, leaving 3 to be interpolated.

38. *Thermograph dry-bulb.*—No tabulation was obtained for 1889 September $21^d\ 0^h$, but an eye-observation was available, and was adopted instead. The recording paper had been wrapped upon the cylinder by a practising operator, and was torn without its being noticed at the time.

The aggregate of all the interruptions of the thermograph dry-bulb in the years 1888 and 1889 was $2^h\ 14^m$; only one hourly tabulation was lost, and the place of it was supplied by an eye-observation.

39. *Thermograph wet-bulb.*—No tabulation was obtained for 1889 September $21^d\ 0^h$, but an eye-observation was available, and was adopted instead. The recording paper had been wrapped upon the cylinder by a practising operator, and was torn without its being noticed at the time.

* If not unusually prolonged, the short interruptions caused by the regular changing of photographic papers and by changing of lamps are not included in the above aggregate, nor in the aggregates of interruptions of the thermograph that follow further on.

The aggregate of all the interruptions of the thermograph wet-bulb in the years 1888 and 1889 was $18^h\ 51^m$, made up chiefly of short intervals of time occupied in cleaning and renewing the muslin coverings of the bulbs and the bundles of threads connecting them with the supply of water. Only one hourly tabulation was lost and the place of it was supplied by an eye-observation.

40. *Self-registering Rain-gauge.*—There was no loss of hourly tabulations in the years 1888 and 1889.

II.—MAGNETICAL INSTRUMENTS, 1888 AND 1889.

Kew Absolute Declinometer and Deflection and Vibration Apparatus.

41. A description of this instrument, with which the observations of absolute declination and of horizontal intensity for the years 1888 and 1889 have been taken, will be found on pages xxxiii to liii of the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70"; the description includes also an account of the situation of the instrument, of the nature and routine of the observations taken with it—with examples of observation and computation forms filled up with the figures of actual observations—and of the formulæ of reduction and the constants involved in them.

42. The entries in columns 1 to 17 and 19 of the Tables of Observations of Absolute Horizontal Force are copied directly from the computation form: column 18 is given to show the degree of accordance existing in the determinations from deflections with the deflecting magnet at the respective distances 0·8 foot and 1·0 foot from the deflected magnet; and the numbers in column 21 are the products of those in column 20 multiplied by the constant number ·46108.

43. The description, referred to above, of the observation of absolute declination will render clear the meaning of the numbers entered in each column of the Tables of Observations of Absolute Declination: all of these, except the monthly means in columns 12 and 13, are taken directly from the observation form.

Kew Dip Circle.

44. A description of this instrument, and of the mode of using it, is also given in the Introduction to the "Bombay Magnetical and Meteorological Observations, 1865—70", pages lvi to lix, and the following additional or corrective remarks will make it applicable to the observations of 1888 and 1889:—

(1) The place of observation has been the top room of the Electrometer Tower, the dip circle having been placed on the same pillar on which the Kew unifilar magnetometer is placed in the regular observations of absolute horizontal force and absolute declination. The reading of the azimuth circle adopted for this place has invariably been 63° 31′. An observation for the verification of this reading was made on the 22nd February 1881.

(2) The dip needles used for the regular observations during the years 1888 and 1889 have been as follows:—

From January 6 to December 25, 1888, John Dover No. 2
" " 3 " " 28, " " " No. $\frac{2}{81}$
" " 4 " " 24, 1889, Dover, Charlton No. 1
" " 1 " " 31 " " " No. 2

For supplementary observations:—

From January 6, 1888 to December 24, 1889, John Dover No. $\frac{1}{81}$
" " 3 " " 28, 1888, Adie No. 5
" January 1 to December 31, 1889, John Dover No. $\frac{2}{81}$

and for trial observations during periods when the adjustments of the dip circle were being altered from time to time:—

John Dover	No. $\frac{1}{21}$
Adie	No. 5
John Dover	No. $\frac{1}{21}$
,, ,,	No. 2
Dover, Charlton	No: 1
,, ,,	No. 2

(3) The final cleaning of the axles of the needles has throughout been made with a clean silk cloth.

(4) The dip circle, which had become somewhat stiff, was taken to pieces and cleaned between the 10th and 17th December 1887 and again between the 10th and 30th December 1888: the worn parts of the lifter were either re-shaped or renewed, and the V's were re-adjusted on several occasions during the two intervals.

CHARLES CHAMBERS,
Director.

Coldbo Observatory, June 1890.

TABLES OF RESULTS

DERIVED

FROM THE CONTINUOUS REGISTRATIONS OF AUTOMATIC METEOROLOGICAL INSTRUMENTS

AND FROM

METEOROLOGICAL OBSERVATIONS,

1888 AND 1889.

TABLES OF RESULTS

DERIVED FROM THE

METEOROLOGICAL OBSERVATIONS MADE DAILY AT 6, 10, 14, 16, AND 22 HOURS,

1888 AND 1889.

FIVE-DAY MEANS,

1888 AND 1889.

P 203—1 B

TABLE I.—Barometric Pressure, 1888.

Height of Barometer above mean Sea-level = 37 feet.

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·955	29·944	29·906	29·838	29·818	29·696	29·675	29·692	29·794	29·850	29·812	29·942
2	·943	·994	·917	·836	**·856**	·720	·678	·690	·802	·839	·770	**·915**
3	·924	30·048	·910	·797	·848	·712	·702	·675	·824	·843	**·761**	·916
4	**·891**	·044	·905	·776	·832	·712	·685	·681	·847	·869	·785	·957
5	30·006	·034	·866	·777	·822	·692	·644	·688	·838	·863	·805	·954
6	**·061**	**·051**	·897	·776	·777	·640	·633	·675	·823	·863	·819	·926
7	·058	·022	·927	·776	·764	·605	·639	**·640**	·808	·894	·819	·930
8	·045	29·998	·913	·769	·790	·626	·663	·652	·787	·881	·824	·927
9	·021	·968	·879	·772	·779	·662	·672	·693	·793	·903	·843	·935
10	·005	·956	·877	·771	·787	·628	·673	·719	·808	·917	·858	·939
11	·004	·933	·907	·780	·757	**·585**	·675	·668	·835	**·932**	·856	·979
12	29·981	·914	·906	·773	·702	·601	·655	·669	·807	·891	·882	·988
13	·936	·913	·969	·785	·695	·671	·662	·702	·784	·833	·916	·951
14	·911	·924	**30·015**	·771	·722	·707	·615	·732	·780	·853	·919	·944
15	·902	**·883**	29·941	**·755**	·795	·652	**·586**	·738	·779	·840	·928	·941
16	·925	·890	·887	·788	·795	·628	·638	·743	·751	·848	·950	·944
17	·948	·899	·917	·828	·780	·663	·693	·736	**·708**	·868	·948	·961
18	·973	·930	·927	**·874**	·769	·696	·720	·712	·720	·844	·929	30·025
19	·978	·941	·865	·864	·742	·684	·708	·660	·806	·869	·863	**·038**
20	·963	·933	·878	·859	·769	·668	·709	·672	·890	·873	·870	·018
21	·963	·944	·842	·860	·761	·670	·699	·705	·933	·869	·904	29·986
22	·945	·926	·836	·866	·736	·673	·705	·717	**·955**	·869	·925	·978
23	·990	·899	·836	·873	·722	·698	·722	·709	·919	·868	·918	·986
24	·981	·909	·835	·855	·711	**·721**	·712	·734	·892	·879	·928	·989
25	·992	·975	·856	·830	·715	·689	·696	·791	·910	·897	·942	30·000
26	·960	·996	·862	·813	**·685**	·628	**·741**	**·801**	·911	·905	·954	·003
27	·968	·933	·846	·830	·712	·626	·729	·779	·898	·860	**·967**	29·965
28	·983	·893	·849	·820	·715	·656	·705	·790	·846	**·794**	·965	·952
29	·976	·886	·901	·805	·711	·646	·702	·796	·829	·812	·955	·949
30	30·028		·881	·787	·722	·665	·707	·786	·848	·825	·935	·930
31	·013		**·819**		·707		·701	·783		·818		·932
Monthly Mean.	**29·975**	29·951	29·889	29·810	29·758	**29·664**	29·682	29·717	29·830	29·864	29·885	29·961
Annual Variation ...	+·143	+·119	+·057	—·022	—·074	—·168	—·150	—·115	—·002	+·032	+·053	+·129

	in.
Annual mean	29·832
The greatest mean daily barometric pressure in the year (that of 6th January) was	30·061
The least do. do. do. (that of 11th June) was	29·585
Difference =	0·476

TABLE II.—Temperature of the Air, 1888.

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	75·2	75·9	79·4	**80·6**	82·6	86·1	80·0	78·7	80·3	80·8	84·8	79·5
2	74·1	77·6	78·9	82·1	82·8	**86·6**	80·5	**76·6**	80·7	81·6	**85·5**	80·2
3	71·8	76·5	79·3	83·0	82·7	86·5	82·6	78·5	80·3	81·1	85·3	80·7
4	**71·2**	75·6	78·9	81·3	81·7	85·3	80·6	80·1	80·7	80·7	84·0	**80·8**
5	73·9	73·8	78·6	81·1	**81·6**	84·8	78·9	**80·8**	81·0	81·6	82·3	80·2
6	75·7	74·0	78·2	81·0	82·4	84·1	81·7	80·6	80·5	81·2	80·7	78·4
7	**77·0**	74·0	77·8	82·1	82·5	80·9	**83·1**	80·4	80·2	80·9	79·8	77·5
8	75·5	74·2	**77·5**	82·8	81·9	80·7	83·1	80·6	80·6	**80·5**	80·7	77·0
9	75·4	74·2	77·5	82·4	81·8	81·7	82·6	80·7	80·7	80·5	80·9	78·0
10	74·3	72·1	78·6	81·1	82·6	84·0	82·7	79·8	81·6	83·3	81·5	78·2
11	73·5	**71·8**	78·5	82·9	83·5	84·0	83·0	78·8	**79·1**	83·6	80·8	78·4
12	73·5	74·7	78·4	83·4	84·8	81·7	82·3	79·6	79·9	82·6	80·7	76·6
13	73·4	76·3	78·4	**83·9**	85·1	82·8	78·1	80·5	80·8	83·2	82·8	75·1
14	73·4	75·5	78·3	83·8	84·7	83·3	**77·5**	79·6	81·4	83·6	83·8	75·3
15	74·0	75·5	78·3	82·9	84·8	82·9	78·6	80·1	81·1	84·5	82·7	76·5
16	74·1	75·8	78·4	82·9	84·7	81·8	78·8	79·5	81·3	84·0	81·4	78·9
17	74·5	76·0	78·7	82·5	84·8	84·4	81·6	80·3	81·4	83·3	80·2	79·9
18	75·3	76·6	79·2	83·1	85·1	84·6	81·7	79·9	81·6	83·8	78·9	80·1
19	75·6	76·4	81·4	83·2	85·4	85·4	81·8	79·7	81·7	84·8	**77·9**	78·1
20	75·1	75·8	83·5	82·7	85·3	85·5	81·2	79·3	81·3	83·1	78·1	75·5
21	73·8	75·9	**84·8**	83·3	84·9	82·6	81·5	80·0	80·6	82·3	78·0	74·7
22	74·1	77·4	82·6	83·0	84·9	80·5	81·2	80·4	81·7	82·0	78·4	**74·4**
23	75·0	77·7	82·4	82·8	85·7	81·1	81·9	79·6	80·7	81·4	78·8	75·2
24	74·7	77·2	81·5	82·9	85·3	82·9	81·7	78·7	**81·8**	82·5	78·9	76·0
25	74·6	76·6	79·5	83·0	84·9	83·6	81·2	78·6	81·2	83·6	79·3	77·0
26	74·9	75·8	79·2	82·5	84·7	82·9	81·8	79·7	81·6	83·2	80·3	75·6
27	72·9	77·2	81·6	81·6	85·1	82·7	82·2	79·9	81·5	82·3	79·5	75·7
28	71·2	78·5	81·6	82·5	85·1	79·6	82·0	79·2	81·0	83·5	79·0	75·6
29	72·0	**79·0**	81·6	82·9	85·1	**78·7**	81·0	79·4	81·5	84·6	78·8	75·3
30	73·6		80·6	82·5	85·4	78·8	79·6	80·4	81·1	**85·6**	79·2	74·4
31	74·6		81·1		**85·8**		79·5	79·9		84·6		74·8
Monthly Mean.	**74·1**	75·8	79·8	82·5	**84·1**	83·0	81·1	79·7	81·0	82·7	80·8	77·2
Annual Variation ...	—6·0	—4·3	—0·3	+2·4	+4·0	+2·9	+1·0	—0·4	+0·9	+2·6	+0·7	—2·9

	°
Annual mean	80·1
The greatest mean daily temperature of the air in the year (that of 2nd June) was	86·6
The least do. do. do. (that of 4th January) was	71·2
Difference =	15·4

TABLE III.—Pressure of Vapour, 1888.

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·690	0·682	0·766	0·793	0·793	0·930	0·903	0·876	0·849	0·826	0·761	0·767
2	·690	**·754**	·720	·779	·824	·946	·907	·850	·839	·836	·848	**·797**
3	·631	·722	·754	**·690**	·782	·942	·946	·871	·832	·869	·880	·779
4	·648	·681	·767	·792	**·705**	·923	·922	·883	·822	·864	**·898**	·736
5	**·697**	·553	·764	·793	·723	·944	·897	**·892**	·828	**·932**	·867	·597
6	·692	·570	·780	·822	·750	·951	·954	·877	·807	·920	·865	·594
7	·683	·582	·743	·855	·755	·933	**·973**	·876	·808	·874	·857	·622
8	·661	·598	·719	·818	·775	·881	·949	·869	**·798**	·831	·885	·631
9	·568	·516	·711	·801	·803	·916	·932	·875	·846	·811	·870	·731
10	·497	**·412**	·751	·825	·856	·960	·934	·863	·874	·817	·854	·704
11	·550	·530	·757	·845	·894	·951	·925	·855	·885	·840	·824	·589
12	·578	·668	·704	·791	·957	·918	·898	·856	·882	·886	·793	**·525**
13	·548	·707	**·656**	·788	·966	·942	**·854**	·878	**·902**	·894	·856	·534
14	·582	·681	·694	·806	·931	·934	·865	·869	·887	·883	·857	·567
15	·629	·657	·710	·902	·899	·950	·880	·872	·853	·812	·788	·548
16	·662	·580	·745	**·920**	·877	·946	·887	**·846**	·841	·816	·693	·628
17	·663	·630	·744	·902	·875	·972	·910	·861	·852	·834	**·596**	·678
18	·681	·722	·768	·882	·863	**·976**	·901	·864	·878	·856	·615	·680
19	·661	·691	·790	·833	·879	·942	·882	·858	·885	·777	·634	·634
20	·614	·690	·828	·853	·880	·929	·900	·866	·886	·773	·617	·620
21	·574	·628	·886	·868	·866	·925	·913	·868	·891	·743	·648	·626
22	·667	·606	**·938**	·882	·900	·917	·916	·862	·898	·751	·654	·616
23	·685	·703	·869	·852	·973	·905	·922	·853	·857	**·731**	·674	·635
24	·632	·716	·834	·824	**·977**	·910	·913	·866	·874	·803	·700	·623
25	·638	·687	·768	·864	·929	·940	·890	·865	·861	·812	·710	·575
26	·643	·618	·735	·879	·898	·945	·884	·847	·868	·834	·692	·586
27	·504	·672	·717	·852	·902	·948	·888	·849	·858	·833	·656	·607
28	**·493**	·738	·777	·879	·919	·905	·882	·849	·844	·890	·698	·594
29	·517	·740	·884	·883	·945	·880	·884	·859	·832	·863	·703	·602
30	·536		·856	·843	·936	**·872**	·860	·867	·835	·879	·730	·585
31	·643		·778		·932		·875	·847		·867		·578
Monthly Mean...	**0·618**	0·646	0·771	0·837	0·870	**0·931**	0·905	0·864	0·856	0·837	0·757	0·632
Annual Variation ...	—·176	—·148	—·023	+·043	+·076	+·137	+·111	+·070	+·062	+·043	—·037	—·162

	in.
Annual mean	0·794
The greatest mean daily pressure of vapour in the year (that of 24th May) was	0·977
The least do, do. do. (that of 10th February) was ...	0·412
Difference =	0·565

TABLE IV.—Additional Capacity of the Air, 1888.

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·185	0·219	0·242	0·254	0·325	0·319	0·124	0·106	0·188	0·228	**0·443**	0·244
2	·154	·198	·271	·321	·299	·323	·135	**·066**	·208	·243	·380	·239
3	·149	**·194**	·251	**·446**	·340	**·325**	·168	·103	·205	·192	·337	·272
4	**·116**	·206	·224	·278	**·383**	·297	·123	·142	·228	·187	·267	·322
5	·142	·284	·216	·276	·364	·254	·091	·159	·231	·151	·243	**·440**
6	·202	·275	·185	·238	·363	·222	·127	·169	·235	**·146**	·186	·381
7	·251	·265	·213	·246	·359	·122	·161	·162	·223	·185	**·163**	·325
8	·226	·253	·228	·306	·316	·170	·182	**·177**	**·248**	·214	·164	·303
9	·318	·331	·236	·310	·286	·165	·184	·174	·202	·233	·185	**·233**
10	**·357**	**·379**	·228	·241	·261	·208	·184	·154	·207	·333	·221	·269
11	·282	·254	·221	·282	·254	·214	·206	·129	**·108**	·318	·228	·390
12	·250	·194	·270	·358	**·241**	·163	·205	·155	·143	·232	·261	·397
13	·280	·203	·317	·379	·242	·181	·108	·162	·151	·247	·275	·345
14	·247	·203	·276	·357	·264	·208	**·077**	·142	·186	·276	·308	·321
15	·215	·230	·260	·225	·293	·175	·099	·155	·211	·383	·334	·376
16	·185	·316	·230	·212	·319	·139	·098	·161	·228	·356	·385	·374
17	·192	·268	·240	**·211**	·326	·213	·168	·173	·219	·309	·442	·349
18	·201	·197	·231	·251	·349	·212	·180	·159	·202	·312	·376	·355
19	·228	·221	·287	·304	·345	·279	·206	·155	·198	**·431**	·327	·333
20	·261	·203	·321	·268	·337	·293	·165	·134	·183	·366	·350	·267
21	·262	·269	·318	·275	·336	·189	·162	·157	·154	·367	·316	·239
22	·179	·340	**·179**	·248	·304	·126	·150	·175	·185	·347	·325	·238
23	·186	·248	·239	·271	·261	·158	·167	·159	·194	·348	·319	·249
24	·232	·220	·240	·305	·242	·216	·170	·117	·213	·316	·295	·281
25	·222	·230	·242	·268	·271	·211	·177	·112	·210	·349	·297	·361
26	·222	·277	·270	·233	·296	·179	·203	·166	·214	·305	·347	·306
27	·306	·267	**·366**	·230	·309	·171	**·213**	·171	·220	·274	·358	·288
28	·273	·242	·308	·233	·290	·105	·212	·148	·217	·263	·297	·299
29	·273	·255	·196	·245	·266	**·103**	·175	·144	·246	·330	·287	·278
30	·297		·191	·269	·283	·112	·149	·171	·227	·355	·273	·273
31	·219		·287		·305		·133	·174		·324		·294
Monthly Mean.	0·229	0·250	0·251	0·278	0·304	0·202	0·158	**0·149**	0·203	0·288	0·300	**0·311**
Annual Variation ..	—·015	+·006	+·007	+·034	+·060	—·042	—·086	—·095	—·041	+·044	+·056	+·067

	in.
Annual mean	0·244
The greatest mean daily additional capacity of the air in the year (that of 3rd April) was	0·446
The least do. do. do. (that of 2nd August) was	0·066
Difference =	0·380

Rainfall, 1888.

TABLE V.—*Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	MONTH.											
	in.		in.			in.	in.	in.	in.	in.	in.	
1	0·03						2·52	1·03	0·03			
2							0·99	**2·83**	0·01			
3	0·16						0·16	0·45		0·11		
4	**1·48**						0·85	0·33			0·23	
5						0·21	2·54	0·15			0·17	
6						0·35	0·34	0·15			**0·33**	
7						1·32	0·07	0·30	0·03		0·08	
8						1·21		0·09			0·24	
9								0·35	0·05		0·02	
10						0·04	0·04	0·62	0·01		0·01	
11							0·26	0·52	**4·15**			
12						0·10	0·43	0·52	0·12			
13						0·07	1·95	0·10				
14						0·14	**4·55**	0·28				
15						0·10	1·59	0·19	0·01			
16						0·21	2·27	0·27				
17							0·44	0·05				
18						0·20	0·07	0·07	0·01			
19							0·07	0·13				
20							0·20	0·80				
21						0·29	0·19	0·06	0·11			
22						1·86	0·13	0·01	0·04			
23			0·09			0·12	0·24	0·29	0·23			
24							0·09	0·78				
25						0·24	0·45	0·34				
26						0·80	0·05	0·04				
27						0·10		0·02				
28						1·85	0·13	0·02				
29						**2·98**	0·11	0·24				
30						2·64	0·39	0·06				
31							0·49					
Monthly Total.	1·67		0·09			14·83	**21·61**	11·09	4·80	0·11	1·08	
Number of rainy days.	3		1			20	28	**30**	12	1	7	

Total fall of rain in the year ... ... 55·28 inches.
Total number of rainy days in the year 102
The greatest daily fall of rain in the year (that of 14th July) was ... ... 4·55 inches.
No rain fell in the months of February, April, May and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1888.

TABLE VI.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1888.*

In Miles per Hour.

1888.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W
1 ...	3·7 N	2·7 E	7·1 N	0·2 E	5·1 N	3·9 W	3·4 N	5·1 W	2·8 S	7·0 W	2·1 N	8·0 W	5·5 S	18·8 W	0·8 N	16·3 W	0·8 S	15·0 W	3·3 N	3·2 W	7·9 N	3·7 E	3·7 N	1·3 E
2 ...	0·1 N	4·0 E	6·1 S	1·2 W	7·8 N	2·9 W	10·8 N	7·7 W	3·6 N	7·6 W	0·8 S	7·9 W	4·8 S	24·1 W	0·0	12·0 W	0·7 S	11·7 W	6·0 N	4·6 W	9·2 N	0·6 E	4·5 N	0·4 E
3 ...	4·9 N	11·5 E	1·8 N	0·5 W	9·5 N	6·0 W	14·8 N	7·2 W	3·4 N	8·3 W	3·4 S	5·3 W	7·2 S	18·0 W	2·1 S	14·7 W	3·2 S	4·3 W	6·9 N	5·3 W	4·1 N	0·1 E	3·5 N	0·8 E
4 ...	4·5 N	10·5 E	7·2 N	3·4 W	11·1 N	5·2 W	6·5 N	8·0 W	4·9 N	6·8 W	14·6 S	0·3 W	5·9 S	11·6 W	7·1 S	17·3 W	0·3 S	4·0 W	6·8 N	0·2 E	2·1 S	2·4 E	5·0 N	2·2 E
5 ...	3·2 N	2·6 E	7·3 N	3·5 W	7·2 N	7·0 W	1·6 N	4·6 W	9·3 N	7·1 W	20·2 S	3·2 W	7·8 S	7·7 W	6·4 S	16·9 W	2·1 N	4·2 W	5·2 N	2·8 W	4·7 S	1·4 E	5·8 N	6·7 E
6 ...	7·5 N	4·1 E	8·7 N	3·0 W	1·5 N	6·3 W	4·1 N	5·6 W	8·3 N	6·1 W	18·1 S	6·6 W	3·0 S	9·7 W	6·7 S	14·8 W	1·4 N	4·8 W	1·5 S	3·4 W	0·8 S	2·4 E	6·8 N	1·9 E
7 ...	8·7 N	4·1 E	8·6 N	3·1 W	6·3 N	5·6 W	6·3 N	5·7 W	6·2 N	9·0 W	14·1 S	0·6 W	6·7 S	16·1 W	6·1 S	16·4 W	2·5 N	5·0 W	2·5 S	1·5 W	1·1 S	5·6 E	7·7 N	1·3 W
8 ...	8·7 N	0·1 E	11·6 N	3·6 W	3·9 N	4·5 W	5·0 N	6·0 W	3·9 N	7·6 W	17·1 S	1·5 E	7·8 S	18·8 W	6·7 S	16·5 W	1·2 N	6·8 W	4·5 N	3·1 W	6·7 S	7·1 E	6·3 N	0·7 W
9 ...	5·6 N	3·9 E	11·7 N	2·7 W	2·2 N	5·1 W	5·9 N	7·4 W	3·7 N	7·9 W	17·4 S	1·2 E	8·5 S	20·4 W	4·2 S	16·6 W	2·9 N	7·4 W	9·3 N	2·8 W	13·1 S	0·4 E	5·0 N	0·0
10 ...	3·2 N	4·1 E	9·1 N	1·8 W	2·1 S	5·4 W	7·2 N	8·9 W	2·9 N	6·5 W	8·7 S	4·4 W	1·7 S	19·2 W	0·4 N	18·1 W	4·2 N	4·4 W	5·4 N	0·1 W	3·0 S	3·1 W	2·8 N	0·0
11 ...	6·9 N	1·5 E	2·1 N	1·1 E	2·5 S	4·8 W	12·2 N	8·7 W	5·5 N	7·9 W	15·9 S	0·4 E	1·5 S	19·4 W	2·3 S	21·1 W	1·7 N	2·7 W	5·2 N	0·4 W	8·2 N	2·5 W	6·2 N	3·4 E
12 ...	7·9 N	1·6 W	0·0	0·2 W	3·8 S	3·9 W	14·1 N	7·7 W	5·1 S	6·0 W	22·0 S	4·4 E	0·2 N	19·6 W	5·3 S	20·4 W	5·5 N	0·5 W	4·6 N	1·1 W	11·4 N	3·0 W	6·0 N	4·3 E
13 ...	8·0 N	1·1 W	0·7 N	3·1 W	0·6 N	4·6 W	19·0 N	7·4 W	4·7 S	5·4 W	15·8 S	0·8 E	0·9 S	15·8 W	5·4 S	17·0 W	7·1 N	7·1 W	3·3 N	1·0 W	6·4 N	0·5 E	6·1 N	3·2 E
14 ...	6·9 N	1·6 W	2·7 N	1·5 W	4·2 N	4·1 W	17·1 N	10·6 W	3·4 S	7·7 W	12·0 S	6·3 W	0·7 N	15·1 W	0·8 S	12·6 W	8·7 N	10·1 W	2·6 N	1·6 W	6·1 N	1·0 E	5·7 N	2·1 E
15 ...	5·6 N	2·3 W	7·8 N	1·8 W	9·5 N	8·6 W	0·8 S	5·4 W	5·6 S	7·8 W	6·1 S	11·0 W	7·9 S	19·5 W	0·9 S	12·4 W	5·9 N	9·2 W	5·0 N	2·6 E	2·0 N	1·5 E	8·1 N	3·6 E
16 ...	4·5 N	2·2 W	9·4 N	5·4 W	6·5 N	6·9 W	11·1 S	4·8 W	7·3 S	6·9 W	8·8 S	4·9 W	8·3 S	22·2 W	3·2 S	18·0 W	2·7 N	7·8 W	5·5 N	0·7 W	3·8 N	2·6 E	7·4 N	6·5 E
17 ...	6·8 N	0·9 E	8·6 N	4·2 W	6·3 N	9·3 W	5·7 S	5·5 W	7·4 S	9·4 W	2·7 S	7·6 W	7·5 S	19·6 W	9·0 S	21·8 W	0·3 S	14·1 W	3·9 N	0·5 W	4·0 N	5·5 E	7·3 N	5·1 E
18 ...	6·7 N	0·9 W	5·0 N	6·1 W	10·2 N	6·5 W	3·8 S	4·9 W	6·4 S	8·7 W	1·6 S	9·1 W	4·5 S	19·3 W	7·4 S	22·7 W	1·6 S	16·2 W	4·9 N	1·0 E	4·4 N	1·8 E	5·9 N	4·4 E
19 ...	8·7 N	0·6 W	10·8 N	7·5 W	15·8 N	5·8 W	3·3 N	6·9 W	6·3 S	9·6 W	1·3 S	11·4 W	8·6 S	20·8 W	6·6 S	26·0 W	3·8 S	6·6 W	6·5 N	1·3 E	5·1 N	0·4 E	6·7 N	1·8 E
20 ...	6·6 N	2·1 W	9·9 N	6·6 W	3·3 N	3·6 W	4·4 N	6·3 W	1·1 S	12·0 W	1·2 S	11·0 W	9·5 S	24·1 W	9·4 S	22·6 W	8·1 S	0·2 E	3·0 N	1·2 E	6·2 N	0·9 E	3·0 N	1·0 E
21 ...	4·2 N	1·5 W	14·3 N	3·6 W	0·7 S	2·4 W	9·9 N	7·9 W	3·8 N	10·3 W	4·7 S	5·2 W	7·7 S	22·5 W	8·3 S	17·2 W	1·6 S	0·9 W	3·3 N	1·3 E	8·8 N	0·4 E	5·0 N	1·3 E
22 ...	1·5 S	1·6 E	6·2 N	4·0 W	9·4 S	4·9 W	9·1 N	9·5 W	7·9 N	10·8 W	4·2 S	7·0 W	2·1 S	20·3 W	9·1 S	16·6 W	7·0 N	5·9 W	2·2 N	2·2 E	7·1 N	0·5 E	6·3 N	0·7 W
23 ...	2·6 N	0·6 E	4·3 N	6·1 W	2·3 S	3·2 W	4·4 N	6·5 W	6·2 N	9·3 W	9·6 S	1·1 W	0·4 N	16·3 W	9·7 S	22·5 W	8·5 N	3·1 W	2·3 N	2·1 E	4·3 N	3·6 E	4·0 N	1·3 E
24 ...	5·8 N	2·7 W	4·3 N	7·1 W	1·6 N	6·2 W	5·1 N	9·2 W	3·4 N	8·7 W	14·9 S	1·5 W	4·1 S	19·0 W	7·0 S	21·8 W	8·8 N	5·3 W	3·0 N	1·9 E	4·1 N	1·0 E	4·0 N	1·5 E
25 ...	5·8 N	4·8 W	6·5 N	3·8 W	2·8 N	4·1 W	6·9 N	8·5 W	0·8 N	9·0 W	9·7 S	3·3 W	7·5 S	18·1 W	4·7 S	17·9 W	7·4 N	4·0 W	5·6 N	1·3 E	5·0 N	0·8 E	2·7 N	2·9 E
26 ...	3·2 N	2·7 W	12·7 N	6·1 W	8·6 N	4·7 W	8·5 N	9·9 W	6·0 N	8·7 W	8·9 S	9·7 W	8·7 S	20·3 W	6·4 S	16·1 W	7·4 N	3·6 W	1·1 S	3·1 E	7·5 N	0·6 W	4·2 N	0·1 W
27 ...	10·0 N	3·8 W	9·8 N	3·1 W	15·6 N	4·4 W	8·4 N	8·6 W	1·8 N	8·2 W	10·1 S	9·3 W	8·2 S	20·7 W	2·8 S	16·4 W	6·8 N	5·0 W	0·9 N	0·9 W	9·7 N	3·0 W	5·1 N	1·5 E
28 ...	7·5 N	0·7 W	5·1 N	4·0 W	4·2 S	2·7 W	5·2 N	8·2 W	7·0 N	9·5 W	0·5 S	6·9 W	8·6 S	21·1 W	3·0 N	15·1 W	5·1 N	3·1 W	3·8 N	0·3 E	7·5 N	1·9 W	0·6 N	0·1 E
29 ...	7·1 N	1·1 E	6·4 N	4·2 W	4·4 S	2·8 W	6·5 N	7·8 W	4·0 N	10·8 W	4·1 S	16·7 W	7·1 S	19·4 W	2·5 N	11·2 W	3·4 N	5·2 W	5·7 N	1·6 E	8·5 N	1·8 W	6·1 N	0·3 W
30 ...	6·1 N	0·2 W			1·1 N	5·9 W	2·0 N	7·9 W	3·8 N	9·9 W	5·8 S	20·7 W	5·7 S	17·9 W	1·7 S	19·0 W	3·3 N	3·1 W	7·2 N	0·2 W	5·2 N	0·6 W	9·0 N	0·9 W
31 ...	12·1 N	1·9 W			2·8 N	6·5 W			2·5 N	10·1 W			0·3 S	15·5 W	3·8 S	18·5 W			4·1 N	1·2 W			6·3 N	0·2 E
Monthly Mean ...	5·9 N	0·7 E	6·7 N	3·4 W	3·7 N	5·1 W	6·0 N	7·3 W	1·6 N	8·4 W	9·1 S	5·7 W	5·4 S	18·4 W	4·4 S	17·6 W	2·8 N	6·0 W	4·0 N	0·5 W	3·8 N	0·9 E	5·4 N	1·7 E
Annual Variation ...	4·2 N	6·5 E	5·0 N	2·4 E	2·0 N	0·7 E	4·3 N	1·5 W	0·1 S	2·6 W	10·8 S	0·1 E	7·1 S	12·6 W	6·1 S	11·8 W	1·1 N	0·2 W	2·3 N	5·3 E	2·1 N	6·7 E	3·7 N	7·5 E

The Velocities of the Mean Components for the year are 1·7 N. and 5·8 W.

Velocity of Wind, 1888.

TABLE VII.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time : also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1888.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1	8·9	9·6	8·5	**8·1**	8·5	8·5	20·1	16·7	15·5	7·5	11·7	9·5
2	**5·4**	8·5	11·0	14·5	8·6	**8·4**	25·4	12·6	11·8	9·3	11·5	8·8
3	13·4	9·5	11·7	17·6	9·3	8·8	19·4	15·5	7·6	9·4	**7·4**	8·2
4	**21·6**	10·9	13·0	11·2	9·6	17·5	13·6	18·8	6·2	9·9	8·1	8·8
5	8·0	9·6	12·7	8·2	12·4	22·0	13·7	18·1	7·0	7·7	9·7	**14·0**
6	10·4	11·0	7·6	10·5	13·2	19·8	**12·9**	16·4	6·7	**5·5**	10·3	9·5
7	12·8	11·1	10·6	10·8	12·7	16·1	17·4	17·8	6·9	6·2	8·4	9·8
8	11·8	13·2	7·5	10·6	10·6	19·1	20·4	18·1	7·1	8·2	12·7	7·8
9	11·8	14·2	7·3	11·1	9·4	18·5	22·1	17·4	9·0	10·7	**15·4**	8·2
10	9·3	11·2	7·2	12·8	**7·9**	11·0	19·5	18·3	7·9	7·2	7·4	7·1
11	10·3	**6·7**	7·5	16·2	9·9	17·2	19·8	21·5	8·1	7·7	11·0	12·1
12	10·1	7·2	7·7	17·5	10·2	**25·2**	19·8	21·5	9·0	7·9	12·1	14·0
13	10·2	7·0	**5·3**	**20·8**	11·7	17·5	16·7	18·1	11·6	6·4	9·8	12·0
14	9·0	7·3	9·2	20·6	9·5	14·1	16·2	13·7	13·5	6·4	10·3	10·0
15	8·7	11·5	14·1	8·6	9·8	13·9	21·4	13·1	11·1	9·2	9·2	12·1
16	7·6	12·2	12·2	15·6	10·5	12·3	23·8	18·7	8·3	9·3	8·0	13·4
17	10·3	11·1	11·6	12·9	12·2	9·9	21·1	23·6	14·2	7·1	10·3	13·0
18	9·3	9·9	13·9	9·2	11·0	10·0	20·2	24·2	**16·5**	8·2	8·7	11·5
19	10·8	14·0	**18·5**	8·6	11·7	11·7	22·5	**27·3**	7·8	8·6	8·3	10·8
20	9·6	13·2	7·2	8·9	12·2	11·2	**26·0**	24·5	9·5	7·0	9·7	8·5
21	7·8	**16·5**	7·1	13·2	11·4	8·8	24·1	19·3	**5·7**	8·7	10·7	8·9
22	6·2	8·4	11·2	14·1	**13·7**	10·3	20·7	19·2	9·5	7·7	9·5	8·6
23	8·5	8·9	8·8	9·4	12·0	13·2	16·4	24·6	11·8	7·5	9·2	7·3
24	8·3	9·4	9·3	11·1	10·5	16·4	19·9	23·2	10·9	8·1	7·5	8·5
25	8·9	10·1	6·0	11·1	10·0	11·4	19·5	19·2	9·6	10·1	8·0	9·9
26	8·9	15·5	11·8	14·2	11·2	14·4	22·2	17·6	9·5	**11·1**	9·5	**7·0**
27	12·1	11·4	17·1	13·6	9·9	14·8	22·4	17·0	8·9	7·9	11·2	9·2
28	10·2	8·1	10·7	12·4	12·5	8·7	22·9	16·3	8·6	7·6	9·3	7·2
29	11·7	9·3	8·1	12·1	11·7	18·2	20·8	**12·4**	6·5	10·1	10·3	9·5
30	9·1		7·7	8·4	10·8	22·0	19·2	19·3	6·6	9·4	8·2	10·8
31	14·2		7·8		10·8		16·4	19·2		8·2		9·0
Monthly Mean.	10·2	10·6	10·0	12·5	10·8	14·4	**19·9**	18·8	9·4	**8·3**	9·8	9·8
Annual Variation ...	—1·8	—1·4	—2·0	+0·5	—1·2	+2·4	+7·9	+6·8	—2·6	—3·7	—2·2	—2·2

	Miles.
The Mean Velocity for June to August	17·7
The Mean Velocity for September to May	10·2
The Mean Velocity for the year	12·0
The greatest monthly mean (that of July)	19·9
The least monthly mean (that of October)	8·3
Difference =	11·6
The greatest mean daily Velocity of Wind in the year (that of 19th August) was ...	27·3
The least do. do. do. (that of 13th March) was ...	5·3
Difference =	22·0

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1888.

TABLE VIII.—*Showing, for the year 1888, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew, in each Month, from each of the sixteen Principal Directions: and also the number of Observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several Months, and of different Winds during the same Month.*

1888.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	760	91	8·3	441	62	7·1	874	102	8·6	1,296	116	11·2	497	48	10·4	117	15	7·8	116	20	5·8	37	4	9·2
February ...	641	82	7·8	535	70	7·6	322	45	7·2	251	34	7·4	268	36	7·4	69	8	8·6	34	5	6·8	28	5	5·6
March ...	321	45	7·1	240	32	7·5	78	12	6·5	239	30	8·0	64	10	6·4	20	3	6·7	65	10	6·5	129	20	6·4
April ...	338	54	6·3	217	36	6·0	86	13	6·6	81	15	5·4	34	8	4·2	12	3	4·0	24	5	4·8	131	7	18·7
May ...	63	13	4·8	64	10	6·4	50	9	5·6	49	7	7·0	15	3	5·0	0	0	0·0	0	0	0·0	36	6	6·0
June... ...	2	1	2·0	0	0	0·0	0	0	0·0	12	2	6·0	64	7	9·1	17	2	8·5	393	28	14·0	1,491	81	18·4
July ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	12	1	12·0	9	1	9·0	14	1	14·0	53	3	17·7
August ...	14	2	7·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0
September ...	135	28	4·8	133	26	5·1	120	21	5·7	169	21	8·0	34	7	4·9	72	12	6·0	109	14	7·8	73	8	9·1
October ...	281	44	6·4	256	40	6·4	472	64	7·4	1,142	146	7·8	399	61	6·5	64	7	9·1	40	6	6·7	88	10	8·8
November ...	598	81	7·4	427	61	7·0	523	71	7·4	988	113	8·7	569	55	10·3	359	40	9·0	137	13	10·5	226	16	14·1
December ...	776	120	6·5	288	47	6·1	343	47	7·3	1,834	175	10·5	926	93	10·0	149	18	8·3	0	0	0·0	3	1	3·0
Year ...	3,929	561	7·0	2,601	384	6·8	2,868	384	7·5	6,061	659	9·2	2,882	329	8·8	888	109	8·1	932	102	9·1	2,295	161	14·3

1888.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	69	4	17·2	30	1	30·0	13	2	6·5	8	1	8·0	68	10	6·8	664	68	9·8	1,329	115	11·6	1,253	85	14·7
February ...	52	7	7·4	44	4	11·0	25	3	8·3	93	13	7·2	129	13	9·9	1,132	108	10·5	2,172	150	14·5	1,563	113	13·8
March ...	153	18	8·5	349	37	9·4	221	35	6·3	371	53	7·0	617	71	8·7	1,572	147	10·7	1,686	131	12·9	1,309	90	14·5
April ...	255	16	15·9	189	18	10·5	66	14	4·7	170	20	8·5	621	62	10·0	2,405	174	13·8	2,600	169	15·4	1,749	106	16·5
May ...	131	10	13·1	239	21	11·4	878	91	9·6	898	82	11·0	1,028	95	10·8	2,891	239	12·1	1,527	137	11·1	182	21	8·7
June ...	1,258	60	21·0	2,585	168	15·4	1,009	86	11·7	1,769	124	14·3	1,352	123	11·0	346	31	11·2	39	6	6·5	7	1	7·0
July ...	37	2	18·5	72	6	12·0	195	14	13·9	10,205	489	20·9	3,650	195	18·7	537	30	17·9	17	2	8·5	0	0	0·0
August ...	0	0	0·0	28	3	9·3	421	29	14·5	8,521	419	20·3	4,365	246	17·7	530	37	14·3	108	7	15·4	14	1	14·0
September ...	48	5	9·6	89	12	7·4	146	20	7·3	588	62	9·5	1,477	132	11·2	1,295	137	9·5	1,873	171	11·0	430	44	9·8
October ...	49	7	7·0	28	4	7·0	13	2	6·5	90	9	10·0	299	39	7·7	836	90	9·3	1,281	126	10·2	801	89	9·0
November ...	104	9	11·6	240	19	12·6	77	9	8·6	170	20	8·5	108	16	6·7	424	46	9·2	798	68	11·7	1,282	82	15·6
December ...	4	1	4·0	7	1	7·0	0	0	0·0	43	5	8·6	207	21	9·9	471	45	10·5	835	75	11·1	1,439	95	15·1
Year ...	2,160	139	15·5	3,900	294	13·3	3,064	305	10·0	22,926	1,297	17·7	13,921	1,023	13·6	13,103	1,152	11·4	14,265	1,157	12·3	10,029	727	13·8

TABLE IX.—Barometric Pressure, 1889.

Height of Barometer above Mean Sea-level=37 feet.

1889. Date.	MONTH.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	29·944	29·963	29·998	29·852	29·782	29·710	29·704	29·687	29·814	29·832	29·886	29·894
2	·994	·962	**30·017**	·862	·799	·710	·689	·691	·789	·870	·884	·894
3	·985	30·002	·010	·849	·842	·612	·701	·677	·816	·848	·874	·950
4	·946	29·985	29·997	·846	·829	·526	·681	·659	**·843**	·818	·886	·959
5	·961	·951	30·003	·844	·786	·500	·648	·626	·835	·780	·903	·928
6	·976	·923	29·993	·834	·787	**·475**	·651	**·575**	·823	·738	·916	·909
7	30·024	·933	·961	·824	·799	·561	·630	·584	·799	·755	·903	·953
8	**·028**	·928	·946	·819	·823	·621	·655	·683	·804	·792	·912	·940
9	·009	·953	·933	·838	·787	·682	·697	·720	·814	·819	·916	·878
10	29·996	30·005	·921	·888	·787	·735	·681	·712	·776	·816	·909	**·857**
11	·961	**·013**	·902	**·901**	·811	·735	·617	·730	·742	·795	·915	·904
12	**·939**	29·971	·912	·838	**·852**	·747	·600	·763	·738	·772	·907	**·986**
13	·964	·972	·951	·771	·829	·768	·594	·741	·743	·737	·884	·983
14	·949	·958	·925	·767	·788	·754	·604	·666	·705	·727	·886	·966
15	·939	·929	·923	·762	·784	·708	·569	·653	·671	·724	·913	·981
16	·941	·980	·902	·784	·777	**·784**	·536	·682	·664	·699	·896	·984
17	·970	·981	·900	·801	·793	·674	**·514**	·680	·625	·635	·855	·951
18	·984	·961	·949	·812	·775	·696	·524	·664	**·584**	**·633**	·846	·975
19	·971	·919	·928	·809	·781	·687	·594	·711	·592	·682	·821	·974
20	·960	·926	·885	·808	·759	·685	·618	·746	·638	·757	·817	·915
21	·983	·923	·860	·786	·757	·706	·663	·727	·709	·813	**·809**	·899
22	·989	**·885**	·851	·759	·778	·708	**·727**	·727	·733	·826	·810	·921
23	·953	·910	·881	·783	·772	·722	·720	·716	·737	·822	·820	·949
24	·958	·954	·890	·804	·732	·685	·678	·716	·722	·858	·832	·896
25	·958	·968	·914	·806	·764	·654	·696	·669	·741	·901	·867	·898
26	·995	·968	·926	·803	·789	·614	·695	·646	·767	·915	·891	·910
27	·992	·988	·880	·767	·761	·620	·667	·673	·765	·891	·913	·919
28	·972	·980	·875	**·728**	·726	·622	·651	·718	·777	·914	·926	·904
29	·939		·898	·754	·740	·656	·681	·796	·802	**·923**	**·941**	·917
30	·945		·852	·787	**·694**	·696	·685	·821	·814	·902	·934	·928
31	·960		**·822**		·699		·691	**·829**		·884		·917
Monthly Mean.	**29·970**	29·957	29·923	29·810	29·781	29·666	**29·647**	29·700	29·746	29·803	29·882	29·930
Annual Variation ...	+·152	+·139	+·105	−·008	−·037	−·152	−·171	−·118	−·072	−·015	+·064	+·112

	in.
Annual mean	29·818
The greatest mean daily barometric pressure in the year (that of 8th January) was ...	30·028
The least do. do. (that of 6th June) was ...	29·475
Difference =	0·553

TABLE X.—Temperature of the Air, 1889.

1889. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1	75·8	73·2	75·9	80·1	83·9	87·3	83·7	82·2	81·1	79·0	79·6	74·1
2	76·5	74·9	76·0	79·4	83·2	86·8	83·6	82·0	80·4	80·1	77·8	74·3
3	76·1	74·7	76·2	79·3	83·0	86·8	81·2	82·6	80·6	81·0	77·3	73·3
4	75·0	74·1	77·8	80·9	83·2	87·4	78·8	82·8	81·6	81·4	77·8	73·2
5	74·7	73·8	80·8	81·2	84·0	84·5	78·5	82·2	81·8	80·6	77·8	73·9
6	75·2	75·0	82·9	81·3	84·3	80·6	79·1	81·1	81·7	77·0	77·7	73·4
7	78·4	75·9	81·1	82·5	84·7	82·5	80·5	80·1	81·6	80·5	77·1	74·6
8	78·9	76·6	79·3	80·5	85·8	82·8	79·6	81·5	81·2	81·6	75·7	75·8
9	77·9	76·5	77·8	79·5	85·3	81·8	79·2	82·3	81·6	82·1	75·7	74·8
10	77·6	75·6	78·6	78·9	85·9	83·8	81·4	81·5	81·9	82·6	75·9	74·5
11	76·3	74·6	79·7	80·6	85·7	84·4	78·4	81·4	81·6	82·9	75·4	76·3
12	74·8	75·9	79·8	81·9	85·6	83·3	79·7	81·0	81·9	83·1	74·6	74·7
13	74·9	76·1	80·0	83·9	85·0	84·6	80·3	80·3	82·1	83·6	74·7	73·5
14	74·1	77·4	79·8	83·9	84·9	83·7	81·9	80·1	81·8	82·7	75·0	73·3
15	73·0	77·4	80·2	83·8	85·1	84·1	82·1	78·9	82·6	82·7	76·0	73·4
16	73·1	76·7	80·8	82·1	85·2	84·4	80·4	81·3	81·6	83·9	76·7	73·1
17	74·9	74·8	80·5	81·8	85·5	84·8	78·6	81·3	80·7	83·7	77·8	73·4
18	74·1	73·6	79·4	83·0	85·5	84·5	79·0	80·6	81·0	79·8	77·2	75·0
19	74·1	74·8	78·9	83·6	85·2	82·9	78·4	80·3	83·1	80·9	74·9	75·0
20	75·9	75·3	80·0	83·5	86·1	83·2	80·7	80·8	84·3	79·6	74·2	74·2
21	76·9	76·2	79·1	83·5	86·9	81·6	80·9	81·1	84·8	78·6	74·0	74·4
22	76·4	75·8	76·9	82·0	86·8	82·9	81·4	80·0	84·8	77·5	73·9	75·4
23	74·9	76·0	76·1	82·3	87·1	83·1	81·9	80·7	82·9	77·8	74·9	74·4
24	73·5	76·2	76·6	82·6	87·0	82·3	81·8	81·1	82·7	77·2	77·0	73·5
25	72·7	76·1	78·7	82·4	87·0	79·0	82·2	80·4	82·3	76·8	76·7	72·7
26	73·0	75·9	80·6	82·6	84·7	78·9	82·5	80·4	82·2	76·9	76·1	73·3
27	74·1	75·3	80·5	83·0	86·2	78·9	82·6	79·9	81·7	77·0	76·1	75·6
28	75·1	75·6	79·4	83·6	86·4	80·9	82·8	81·6	80·9	77·1	75·0	78·1
29	74·8		78·5	84·2	86·2	83·0	81·8	81·5	79·4	77·1	73·5	77·4
30	76·6		79·2	84·5	86·3	83·1	82·6	81·4	78·5	78·0	73·6	78·2
31	74·8		80·7		87·0		82·6	81·6		79·9		77·4
Monthly Mean.	75·3	75·5	79·1	82·1	85·4	83·3	80·9	81·1	81·8	80·1	76·0	74·6
Annual Variation ...	−4·3	−4·1	−0·5	+2·5	+5·8	+3·7	+1·3	+1·5	+2·2	+0·5	−3·6	−5·0

	°
Annual mean	79·6
The greatest mean daily temperature of the air in the year (that of 4th June) was ...	87·4
The least do. do. (that of 25th January) was ...	72·7
Difference =	14·7

TABLE XI.—Pressure of Vapour, 1889.

1889. Date.	MONTH.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	0·541	0·479	0·655	0·752	0·849	0·968	0·928	0·900	0·853	0·850	0·676	0·625
2	·585	·572	·626	·795	**·837**	·970	·918	·888	·863	·853	·722	·634
3	·596	·649	·633	·818	·874	**·988**	·922	·886	·861	·892	·690	·620
4	·665	·585	·674	·832	·890	·969	·883	·885	·841	·918	·677	·643
5	·669	·557	·662	·815	·921	**·846**	**·880**	·898	·833	·901	·712	·670
6	·635	·605	·709	·859	·948	·882	·897	·904	·850	·852	**·741**	·597
7	·691	·699	·778	·743	·969	·981	·899	·903	·844	·879	·710	·635
8	·684	·723	·737	**·699**	·978	·968	·902	·910	**·827**	·911	·729	·644
9	·692	**·732**	·725	·713	·980	·965	·910	·907	·859	·945	·637	·613
10	·660	·672	·739	·711	·978	·983	·937	·893	·873	·959	·634	·612
11	·673	·542	·794	·750	·932	·972	·883	·889	·892	**·980**	·611	·577
12	·685	·524	·809	·778	·926	·962	·914	·894	·917	·945	·579	**·486**
13	·664	·589	**·835**	·841	·935	·978	·920	·892	·952	·864	·573	·518
14	·543	·611	·824	·868	·904	·973	**·950**	·878	·934	·843	·577	·539
15	**·468**	·719	·812	·838	·906	·976	·941	·877	·954	·904	·583	·534
16	·518	·723	·779	·887	·937	·974	·931	·908	·899	·916	·624	·535
17	·548	·548	·759	·889	**·981**	·962	·912	·905	·900	·806	·617	·554
18	·535	**·461**	·725	·876	·951	·924	·909	**·912**	·898	·877	**·539**	·537
19	·528	·554	·711	·886	·884	·901	·895	·896	·952	·863	·550	·528
20	·653	·599	·710	·918	·921	·915	·914	·901	**1·001**	·777	·613	·574
21	·668	·600	·699	·874	·931	·900	·914	·888	·001	·779	·593	·587
22	·690	·624	·616	·834	·949	·914	·919	·869	0·977	·761	·606	·575
23	·640	·684	·642	·847	·934	·903	·925	·871	·933	·710	·646	·596
24	·529	·656	**·613**	·865	·930	·904	·916	**·863**	·898	·680	·670	·555
25 , ...	·552	·682	·728	·873	·924	·895	·921	·869	·902	**·677**	·725	·555
26	·589	·617	·805	·860	·873	·900	·922	·889	·935	·706	·726	·558
27	·610	·669	·781	·893	·941	·901	·915	·886	·927	·698	·648	·588
28	·665	·686	·760	**·919**	·970	·918	·909	·904	·909	·710	·646	·693
29	·696		·770	·914	·967	·945	·894	·889	·838	·693	·650	**·770**
30	**·700**		·759	·888	·979	·934	·915	·872	·834	·726	·642	·747
31	·582		·783		·980		·899	·871		·690		·654
Monthly Mean.	0·618	0·620	0·731	0·835	0·932	**0·939**	0·913	0·890	0·899	0·825	0·645	**0·599**
Annual Variation ...	—·169	—·167	—·056	+·048	+·145	+·152	+·126	+·103	+·112	+·038	−·142	−·188

	in.
Annual mean	0·787
The greatest mean daily pressure of vapour in the year (that of 20th September) was ...	1·001
The least do. do. (that of 18th February) was ...	0·461
Difference =	0·540

TABLE XII.—Additional Capacity of the Air, 1889.

1889. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1	**0·361**	0·345	0·244	0·279	0·321	0·330	0·228	0·200	0·210	0·141	0·340	0·222
2	·336	·303	·275	·212	·302	·308	**·234**	·204	·176	·178	·235	·217
3	·312	·212	·275	**·186**	·258	·290	·146	·230	·186	·168	·252	·203
4	·208	·262	·284	·224	·248	·332	·102	**·237**	·240	·157	·284	·178
5	·193	·283	·401	·253	·249	**·338**	·094	·202	**·254**	·149	·250	**·167**
6	·244	·267	**·429**	·212	·234	·165	·097	·156	·235	**·077**	·214	·228
7	·288	·199	·286	**·374**	**·224**	·131	·144	·125	·236	·165	·223	·230
8	·313	·199	·267	·345	·261	·157	·112	·165	·238	·169	**·165**	·254
9	·269	**·183**	·232	·296	·239	·123	·089	·197	·222	·152	·258	·257
10	·291	·215	·240	·281	·262	·177	·134	·184	·216	·155	·264	·251
11	·233	·318	·225	·297	·303	·209	·088	·184	·189	·148	·275	·337
12	·182	**·384**	·212	·317	·305	·181	·100	·165	·175	·190	·285	**·380**
13	·203	·320	**·192**	·329	·272	·210	·112	·142	·146	·292	·293	·314
14	·303	·340	·195	·296	·300	·180	·139	·151	·157	·276	·300	·291
15	·349	·226	·220	·324	·309	·193	·154	**·110**	·164	·218	·327	·298
16	·302	·198	·276	·213	·277	·206	·107	·160	·184	·251	·304	·289
17	·323	·318	·288	·199	·244	·237	**·065**	·163	·150	**·353**	·344	·276
18	·311	·374	·281	·258	·274	·259	·081	·132	·162	·144	**·401**	·340
19	·318	·317	·280	·269	·333	·223	·075	·139	·184	·192	·320	·348
20	·251	·284	·317	·231	·328	·225	·133	·152	·178	·236	·237	·277
21	·263	·311	·300	·266	·351	·185	·140	·174	·195	·202	·251	·272
22	·223	·272	·310	·262	·334	·212	·153	·154	·219	·187	·236	·314
23	·228	·219	·262	·258	·354	·231	·165	·177	·192	·245	·225	·262
24	·301	·250	·306	·250	·355	·201	·171	·198	·221	·256	·264	·276
25	·257	·229	·259	·235	**·360**	·096	·179	·170	·202	·248	·198	·255
26	·229	·281	·243	·256	·324	·089	·191	·149	·168	·223	·178	·270
27	·238	·211	·264	·238	·311	**·086**	·200	·135	·156	·234	·258	·306
28	·211	·204	·247	·235	·290	·138	·213	·174	·145	·225	·224	·275
29	**·172**		·206	·261	·284	·183	·191	·187	·166	·244	·185	·172
30	·221		·244	·301	·277	·200	·201	·200	**·141**	·241	·189	·225
31	·282		·268		·305		·217	·207		·340		·287
Monthly Mean.	0·265	0·269	0·269	0·265	**0·293**	0·203	**0·144**	0·172	0·190	0·208	0·259	0·267
Annual Variation ...	+·031	+·035	+·035	+·031	+·059	—·031	—·090	—·062	—·044	—·026	+·025	+·033

	in.
Annual mean	0·234
The largest mean daily additional capacity of the air in the year (that of 6th March) was ...	0·429
The least do. do. do. (that of 17th July) was ...	0·065
Difference=	0·364

Rainfall, 1889.

TABLE XIII.—*Total Fall of Rain (in inches) as measured by F. Chambers's Self-registering Gauge, the funnel of which is 28 feet above the ground.*

1889.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
					in.	in.	in.	in.	in.	in.		
1							0·01	0·07	0·25	0·05		
2						0·03		0·31	0·39			
3							1·13	0·02	0·15			
4							1·16	0·45		0·10		
5						0·01	2·11	0·22		0·56		
6						2·62	0·43	0·17		**2·24**		
7						2·27	0·49	**1·53**				
8						0·20	**3·92**	0·33				
9						0·92	1·89	0·09				
10						0·08	1·27	0·12				
11						0·02	2·63	0·61				
12						0·50	2·92	0·13				
13						0·03	1·18	1·02	0·07			
14						0·38	0·07	1·05	0·01			
15						0·21	0·04	0·75	0·10	0·09		
16						0·16	0·53	0·06	0·21			
17							1·13	0·07	**0·82**	0·39		
18							3·53	0·36		0·18		
19						0·02	3·30	0·58				
20						0·64	0·42	0·22				
21						0·28	0·30	0·09				
22						0·33	0·09	0·51				
23						0·17	0·13	0·03	0·09			
24						0·31	0·18	0·12				
25						3·13		0·16				
26					**0·58**	**3·53**	0·03	0·04				
27						1·25	0·02	0·60	0·05			
28						1·02		0·09	0·17			
29						0·23	0·14	0·18	0·02			
30								**0·01**	0·28			
31								0·06				
Monthly Total...					0·58	18·34	**29·05**	10·05	2·61	3·61		
Number of rainy days ...					1	24	26	**31**	13	7		

Total fall of rain in the year ... ... 64·24 inches.
Total number of rainy days in the year 102
The greatest daily fall of rain in the year (that of 8th July) was ... ... 3·92 inches.

No rain fell in the months of January, February, March, April, November and December, nor on any of the days left blank in the above table.

Mean Daily Velocities of the North and East Components of the Wind, 1889.

TABLE XIV.—*Showing the Mean Velocities of the North or South and East or West Components of the Winds which blew on each day of the year 1889.*

In Miles per Hour.

1889.	MONTH.																							
Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.	N. or S.	E. or W.
1	4·0 N	2·6 E	11·9 N	3·4 W	7·0 N	6·0 W	9·2 N	6·7 W	4·0 S	7·2 W	3·7 S	7·6 W	4·7 S	7·3 W	4·0 S	10·1 W	4·8 N	12·1 W	10·7 S	0·0	7·2 N	2·6 E	6·9 N	1·0 W
2	5·0 N	3·6 E	6·5 N	0·3 E	9·5 N	3·0 W	6·7 N	7·8 W	1·5 S	5·9 W	1·5 S	7·4 W	5·6 S	5·1 W	4·5 S	12·7 W	2·4 N	8·3 W	5·6 S	0·7 E	6·9 N	0·4 W	2·5 N	0·5 E
3	0·6 S	1·0 E	11·4 N	3·1 W	12·8 N	5·5 W	4·6 N	7·2 W	5·1 N	6·2 W	2·7 N	7·3 W	8·6 S	1·1 W	3·5 S	13·4 W	1·4 N	0·5 W	4·3 N	2·8 W	5·8 N	1·0 E	2·7 N	1·3 E
4	4·2 N	0·1 E	10·1 N	4·5 W	10·2 N	3·7 W	7·8 N	6·8 W	4·0 N	8·2 W	1·4 N	2·8 W	5·5 S	3·4 W	4·5 S	15·5 W	5·8 N	3·3 W	5·0 N	2·4 W	4·9 N	3·1 E	9·5 N	1·8 W
5	8·8 N	2·3 W	10·3 N	2·7 W	6·2 N	1·6 W	11·3 N	8·7 W	4·3 N	8·4 W	2·9 S	10·1 E	7·1 S	3·0 W	4·0 S	18·4 W	7·3 N	4·1 W	4·1 N	2·1 W	5·3 N	1·9 E	12·9 N	3·6 W
6	6·4 N	1·4 W	11·1 N	4·1 W	1·7 N	0·7 E	8·2 N	6·7 W	5·9 N	7·6 W	27·7 S	23·5 E	9·5 S	2·8 W	1·6 N	15·2 W	4·1 N	4·6 W	4·5 S	2·7 E	5·9 N	3·8 E	10·0 N	1·8 W
7	2·8 N	1·9 E	7·8 N	2·7 W	2·3 N	2·0 W	9·9 N	7·9 W	2·2 S	7·0 W	33·4 S	5·6 E	3·2 S	13·1 W	0·3 S	16·8 W	3·6 N	2·2 W	18·1 S	7·0 E	6·3 N	0·5 E	6·5 N	1·1 E
8	3·3 N	0·9 E	0·9 N	3·0 W	4·0 N	5·4 W	5·2 N	5·5 W	0·5 N	5·8 W	20·9 S	0·1 W	5·6 S	7·6 W	2·8 S	20·9 W	5·6 N	2·4 W	5·3 S	1·0 E	6·9 N	2·8 W	3·7 N	1·5 E
9	4·5 N	0·4 W	1·4 N	5·7 W	3·5 N	4·1 W	3·3 N	5·6 W	2·8 S	5·5 W	8·0 S	2·1 W	6·4 S	6·5 W	1·6 S	17·6 W	7·2 N	4·2 W	0·4 S	3·3 W	6·9 N	0·4 W	7·9 N	0·4 W
10	6·4 N	1·4 W	4·0 N	3·8 W	2·5 N	3·2 W	4·6 N	5·8 W	4·9 S	6·8 W	1·6 S	10·4 W	4·7 S	18·2 W	0·0	19·5 W	7·4 N	5·1 W	8·5 N	6·0 W	6·6 N	0·8 E	6·1 N	1·6 E
11	8·3 N	3·1 W	10·7 N	3·7 W	1·5 N	2·7 W	9·7 N	8·7 W	2·9 S	7·5 W	1·9 S	12·7 W	5·2 S	19·4 W	0·3 S	20·2 W	7·9 N	4·8 W	7·8 N	3·3 W	6·8 N	2·1 E	6·1 N	9·4 E
12	3·2 N	3·8 W	8·7 N	1·0 E	4·8 S	3·1 W	11·1 N	7·9 W	1·4 N	8·2 W	0·8 S	15·3 W	2·9 S	21·5 W	0·0	19·3 W	6·7 N	5·8 W	6·4 N	1·6 W	5·8 N	2·4 E	4·2 N	5·0 E
13	6·8 N	1·9 W	7·3 N	0·4 W	6·1 S	3·0 W	14·7 N	7·7 W	2·6 N	6·5 W	0·0	17·8 W	4·8 S	17·6 W	0·6 N	18·2 W	3·5 N	3·3 W	6·6 N	1·7 E	5·9 N	4·4 E	6·9 N	2·7 E
14	11·3 N	0·3 W	6·2 N	1·2 W	1·5 S	2·8 W	11·7 N	7·8 W	2·8 N	7·4 W	3·7 S	17·7 W	4·2 S	11·2 W	1·7 S	18·3 W	4·4 N	0·5 W	1·5 N	0·3 W	5·9 N	4·5 E	5·5 N	2·9 E
15	11·3 N	3·2 W	1·8 S	2·3 W	1·0 S	4·1 W	8·9 N	6·9 W	1·4 N	6·5 W	7·7 S	18·5 W	2·3 S	9·4 W	6·8 S	17·5 W	0·9 N	1·5 E	1·2 N	3·8 E	7·4 N	3·4 E	5·9 N	4·2 E
16	9·4 N	2·0 W	0·1 S	5·3 W	2·8 N	6·7 W	1·2 S	6·1 W	5·8 N	7·3 W	4·9 S	14·7 W	2·7 S	11·5 W	8·6 S	20·7 W	1·3 S	0·5 E	7·3 N	1·7 W	7·4 N	3·3 E	4·3 N	2·0 E
17	6·0 N	0·3 W	10·6 N	5·3 W	8·7 N	6·2 W	0·8 S	4·0 W	1·7 N	8·0 W	3·2 S	11·7 W	4·5 S	9·9 W	7·3 S	21·5 W	0·6 N	2·3 E	9·3 N	2·4 E	9·4 N	3·9 E	5·9 N	1·5 E
18	11·8 N	2·4 W	11·6 N	2·6 W	13·4 N	6·6 W	1·3 N	6·7 W	0·8 N	7·3 W	3·3 N	11·8 W	4·2 S	21·1 W	7·9 S	16·6 W	1·0 N	0·5 E	11·0 N	0·5 W	9·6 N	5·4 E	5·6 N	5·1 E
19	10·1 N	1·6 W	12·2 N	3·6 W	12·3 N	3·8 W	0·2 N	4·6 W	2·7 S	6·3 W	1·4 N	12·0 W	7·9 S	26·9 W	5·1 S	18·0 W	1·5 S	1·0 W	6·8 N	0·9 W	9·5 N	0·9 W	7·0 N	3·8 E
20	1·4 N	0·3 E	6·2 N	1·4 W	11·2 N	6·4 W	4·0 S	5·2 W	0·5 N	9·1 W	2·4 S	7·9 W	8·3 S	19·3 W	3·9 S	18·5 W	0·0	5·3 W	4·1 N	1·9 W	6·7 N	0·6 W	5·5 N	2·9 E
21	2·3 N	1·7 E	6·6 N	0·3 W	6·3 N	7·1 W	0·8 S	6·4 W	2·9 S	10·8 W	1·9 S	5·0 W	7·4 S	14·3 W	1·8 S	20·2 W	3·1 N	8·5 W	1·6 N	1·8 W	6·1 N	1·0 E	5·8 N	3·1 E
22	3·3 N	0·5 W	8·5 N	4·6 W	6·2 N	6·6 W	5·0 N	6·7 W	1·8 S	11·5 W	2·2 S	12·0 W	5·7 S	13·9 W	1·5 S	19·3 W	4·7 N	10·0 W	1·2 S	2·0 E	5·6 N	0·7 W	6·9 N	4·3 E
23	7·8 N	2·3 W	7·9 N	4·5 W	2·0 N	5·3 W	4·3 N	6·8 W	3·1 S	13·0 W	3·7 S	13·2 W	5·1 S	14·7 W	3·4 S	20·6 W	3·4 N	1·8 W	0·5 S	0·7 E	6·7 N	0·2 W	4·7 N	2·7 E
24	11·2 N	3·1 W	5·5 N	3·7 W	3·5 N	5·3 W	9·0 N	7·4 W	2·6 S	10·5 W	7·8 S	16·6 W	6·6 S	13·8 W	3·0 S	17·1 W	7·4 N	0·2 E	0·7 S	3·2 E	5·2 N	0·1 W	5·3 N	2·0 E
25	9·0 N	3·1 W	8·4 N	4·1 W	12·0 N	5·0 W	3·5 N	6·7 W	1·9 S	10·3 W	8·7 S	13·8 W	6·8 S	16·4 W	0·3 S	15·5 W	7·4 N	1·1 W	2·1 N	1·1 E	2·3 N	0·6 E	3·0 N	1·0 E
26	5·8 N	1·4 W	9·7 N	6·9 W	16·3 N	8·3 W	0·4 N	6·5 W	2·7 N	7·2 W	2·4 S	13·2 W	1·0 S	13·4 W	1·7 S	12·4 W	4·3 N	0·2 E	3·8 N	0·5 W	4·0 N	0·8 E	7·3 N	1·7 E
27	4·7 N	1·0 W	3·5 N	4·4 W	11·3 N	8·8 W	0·0	7·0 W	4·1 N	8·7 W	1·4 S	9·4 W	0·9 S	11·9 W	0·5 S	11·4 W	6·6 N	4·3 W	4·7 N	0·8 E	6·3 N	1·0 E	7·7 N	4·2 E
28	1·9 N	1·4 W	0·2 N	5·3 W	3·6 N	4·1 W	0·2 S	6·4 W	7·1 N	10·6 W	0·2 N	13·3 W	1·5 S	12·7 W	1·3 S	12·7 W	4·6 N	6·4 W	6·2 N	0·9 E	6·2 N	1·2 E	4·4 N	0·0
29	2·6 N	2·1 W			4·1 N	4·6 W	5·0 S	7·2 W	3·7 N	9·1 W	7·1 S	16·1 W	0·9 S	14·2 W	1·1 S	11·8 W	4·5 S	5·2 W	7·9 N	0·4 W	7·8 N	2·5 W	0·6 S	2·8 W
30	2·6 S	4·1 W			8·9 N	4·9 W	6·0 S	6·8 W	1·9 N	8·7 W	4·8 S	8·5 W	4·9 S	13·8 W	0·6 N	10·4 W	8·4 S	1·5 W	6·0 N	1·0 E	9·5 N	2·0 W	7·1 N	1·8 W
31	12·0 N	5·1 W			9·3 N	5·1 W			2·9 S	7·3 W			4·1 S	10·6 W	4·1 N	10·0 W			5·0 N	5·8 E			9·1 N	1·4 W
Monthly Mean ...	5·9 N	1·2 W	7·2 N	3·3 W	5·8 N	4·7 W	4·4 N	6·7 W	0·6 N	8·1 W	5·2 S	8·6 W	4·9 S	12·4 W	2·4 S	16·5 W	3·4 N	3·4 W	2·4 N	0·2 E	6·6 N	1·2 E	6·0 N	1·6 E
Annual Variation	3·4 N	4·0 E	4·7 N	1·9 E	3·3 N	0·5 E	1·9 N	1·5 W	1·9 S	2·9 W	7·7 S	3·4 W	7·4 S	7·2 W	4·9 S	11·3 W	0·9 N	1·8 E	0·1 S	5·4 E	4·1 N	6·4 E	3·5 N	6·8 E

The Velocities of the Mean Components for the year are 2·5 N and 5·2 W.

Velocity of Wind, 1889.

TABLE XV.—*Mean Velocity of the Wind, in miles per hour, without regard to the direction from which it blew, for each Day of Bombay Civil Time: also the Mean Monthly Velocity, and its Variation from the Mean of the year.*

1889.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
1 ...	9·0	13·2	11·5	12·8	8·5	9·5	8·8	10·9	**13·1**	12·9	10·8	8·8
2 ...	10·6	13·1	12·6	11·2	**7·5**	**8·3**	**7·9**	13·7	9·5	9·0	9·4	7·9
3 ...	7·3	13·5	14·9	9·0	8·6	10·1	10·4	14·1	7·1	9·1	8·7	7·6
4 ...	9·5	12·2	13·0	11·8	9·2	8·9	10·0	16·4	10·0	8·0	10·1	11·0
5 ...	10·5	11·5	9·1	14·6	9·6	23·1	12·0	19·2	9·5	9·7	7·8	13·8
6 ...	8·1	**14·9**	8·1	11·4	10·9	**39·8**	14·7	16·4	8·3	13·4	9·4	11·2
7 ...	8·3	9·8	7·5	13·8	10·2	35·5	14·2	17·2	7·2	**20·7**	10·5	8·8
8 ...	6·7	6·7	8·4	9·7	7·9	22·1	13·5	21·4	8·4	8·4	8·6	8·4
9 ...	6·7	**6·3**	9·2	8·1	9·2	12·2	13·8	18·0	9·2	7·5	9·1	9·6
10 ...	9·2	8·7	6·2	10·4	10·0	11·1	19·1	19·5	9·3	10·6	10·5	9·0
11 ...	10·9	14·4	5·9	14·2	8·5	13·2	20·7	20·3	9·6	9·9	11·5	**14·8**
12 ...	**6·6**	11·5	8·0	14·7	9·4	15·7	22·8	19·3	9·3	8·1	10·4	12·0
13 ...	10·0	9·0	9·0	**17·2**	8·7	17·8	18·7	18·3	8·7	9·3	11·5	11·5
14 ...	13·6	8·1	8·0	14·5	8·2	18·5	12·1	18·6	8·3	**5·5**	11·8	9·6
15 ...	12·4	6·6	**5·4**	12·5	7·7	20·0	9·9	19·3	7·8	8·0	13·0	11·0
16 ...	10·9	8·6	9·7	7·6	11·0	15·7	12·5	22·4	10·0	10·4	12·0	8·7
17 ...	8·9	12·7	11·7	**7·0**	8·8	12·3	13·8	**22·9**	8·2	13·0	14·0	10·1
18 ...	13·1	13·6	15·7	7·9	7·7	12·4	22·0	18·6	**6·7**	12·0	**15·9**	10·8
19 ...	11·5	14·2	13·6	8·0	8·2	12·3	**28·5**	19·1	7·2	9·7	12·0	11·0
20 ...	6·8	9·0	13·5	7·1	9·4	14·9	21·1	19·3	7·6	6·6	11·1	9·9
21 ...	6·8	9·8	10·1	8·5	11·4	10·1	16·4	20·6	9·1	6·5	10·9	10·5
22 ...	7·1	10·7	9·8	9·6	12·0	12·7	15·0	20·0	11·2	6·5	10·9	11·7
23 ...	9·8	11·1	7·5	9·5	**13·6**	14·3	15·7	21·2	8·6	7·5	9·5	9·5
24 ...	12·8	9·3	8·7	12·8	11·0	19·3	15·4	17·8	9·8	6·8	7·3	9·1
25 ...	10·5	12·0	14·3	8·5	11·0	17·5	17·8	15·8	10·3	7·4	**6·9**	7·4
26 ...	8·3	12·8	**18·8**	7·2	12·0	15·5	13·7	12·8	7·5	7·7	8·2	10·7
27 ...	7·9	7·6	14·9	7·6	11·7	12·0	12·1	12·1	9·0	8·9	9·1	12·6
28 ...	7·2	6·4	8·3	8·1	13·0	19·9	13·0	13·2	9·0	9·3	9·8	7·8
29 ...	6·8		6·4	9·8	10·3	17·7	14·3	12·2	8·1	9·6	10·2	**5·9**
30 ...	8·8		11·6	9·7	9·7	10·0	14·7	**10·5**	11·1	8·9	11·4	9·1
31 ...	**14·2**		13·1		8·4		11·5	11·0		9·9		10·9
Monthly Mean.	9·4	10·6	10·5	10·5	9·8	16·1	15·0	**17·2**	**9·0**	9·4	10·4	10·0
Annual Variation ...	—2·1	—0·9	—1·0	—1·0	—1·7	+4·6	+3·5	+5·7	—2·5	—2·1	—1·1	—1·5

	Miles.
The Mean Velocity for June to August...	16·1
The Mean Velocity for September to May	10·0
The Mean Velocity for the year	11·5
The greatest monthly mean (that of August)	17·2
The least monthly mean (that of September)	9·0
Difference =	8·2
The greatest mean daily Velocity of Wind in the year (that of 6th June) was ...	39·8
The least do. do. do. (that of 15th March) was ...	5·4
Difference =	34·4

Aggregate and Mean Velocities and Relative Frequency of Different Winds, 1889.

TABLE XVI.—*Showing, for the year 1889, the sums of the Velocities, and the Mean Velocities, in miles per hour, of the Winds which blew in each Month, from each of the sixteen Principal Directions; and also the number of Observations which those sums comprise; the latter numbers indicating the Relative Frequency of the same Wind (as to direction) in the several Months and of different Winds during the same Month.*

1889.	N.			N.N.E.			N.E.			E.N.E.			E.			E.S.E.			S.E.			S.S.E.		
Month.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	747	92	8·1	550	76	7·2	318	49	6·5	786	99	7·9	243	34	7·1	245	35	7·0	9	1	9·0	8	1	8·0
February ...	850	98	8·7	339	48	7·1	241	36	6·7	394	43	9·2	87	13	6·7	112	19	5·9	29	8	3·6	31	5	6·2
March ...	530	66	8·0	283	39	7·3	52	9	5·8	281	42	6·7	157	29	5·4	69	12	5·8	50	8	6·2	103	14	7·4
April ...	198	29	6·8	269	47	5·7	48	10	4·8	32	6	5·3	9	2	4·5	27	5	5·4	26	3	8·7	17	3	5·7
May ...	69	11	6·3	50	8	6·2	12	2	6·0	22	5	4·4	12	2	6·0	22	4	5·5	14	3	4·7	46	5	9·2
June ...	9	2	4·5	23	3	7·7	17	2	8·5	355	18	19·7	215	16	13·4	32	1	32·0	840	30	28·0	925	33	28·0
July ...	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	19	2	9·5	29	3	9·7	519	34	15 3
August ...	9	1	9·0	5	1	5·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0	0	0	0·0
September ...	162	33	4·9	146	26	5·6	183	30	6·1	375	49	7·7	377	54	7·0	147	23	6·4	77	14	5·5	91	9	10·1
October ...	366	58	6·3	397	56	7·1	231	30	7·7	935	120	7·8	190	24	7·9	523	58	9·0	273	22	12·4	459	36	12·7
November ...	503	71	7·1	242	43	5·6	462	67	6·9	2,339	224	10·4	329	33	10·0	13	2	6·5	0	0	0·0	0	0	0·0
December ...	613	93	6 6	370	57	6·5	394	51	7·7	1,911	186	10·3	723	77	9·4	81	9	9·0	14	2	7·0	17	3	5·7
Year ...	4,056	554	7·3	2,674	404	6·6	1,958	286	6·8	7,430	792	9·4	2,342	284	8·2	1,290	170	7·6	1,361	94	14·5	2,216	143	15·5

1889.	S.			S.S.W.			S.W.			W.S.W.			W.			W.N.W.			N.W.			N.N.W.		
Month.	Sum of Velocities.	Number of Observations	Mean Velocity.	Sum of Velocities.	Number of Observations	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.	Sum of Velocities.	Number of Observations.	Mean Velocity.
	Miles.		Miles.	Miles		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.	Miles.		Miles.
January ...	18	3	6·0	11	2	5·5	0	0	0·0	119	13	9·2	290	35	8·3	575	62	9·3	1,238	108	11·5	1,821	134	13·6
February ...	13	2	6·5	5	1	5·0	16	3	5·3	156	20	7·8	353	39	9·1	546	61	9·0	1,683	126	13·4	2,286	150	15·2
March ...	67	11	6·1	93	14	6·6	81	16	5·1	281	40	7·0	302	34	8·9	1,228	104	11·8	2,343	174	13·5	1,874	132	14·2
April ...	77	22	3·5	296	39	7·6	201	34	5·9	442	50	8·8	532	54	9·9	1,961	180	10·9	2,379	148	16·1	1,042	87	12·0
May ...	67	8	8·4	324	34	9·5	258	43	6·0	1,427	129	11·1	1,867	182	10·3	2,154	195	11·0	863	105	8·2	76	8	9·5
June ...	708	29	24·4	423	26	16·3	421	39	10·8	3,623	243	14·9	3,176	213	14·9	734	57	12·9	53	6	8·8	19	2	9·5
July ...	321	25	12·8	194	19	10·2	723	73	9·9	5,923	368	16·1	3,177	200	15·9	248	15	16·5	35	5	7·0	0	0	0·0
August ...	0	0	0·0	13	1	13·0	149	11	13·5	5,045	286	17·6	6,970	396	17·6	501	39	12·8	62	6	10·3	19	3	6·3
September ...	103	13	7·9	137	13	10·5	137	17	8·1	219	24	9·1	487	53	9·2	1,308	125	10·5	1,780	153	11·6	724	84	8·6
October ...	359	25	14·4	177	14	12·6	40	8	5·0	212	31	6·8	38	6	6·3	642	65	9·9	1,097	98	11·2	1,039	93	11·2
November ...	7	1	7·0	0	0	0·0	7	1	7·0	19	2	9·5	50	5	10·0	227	22	10·3	1,525	117	13·0	1,772	131	13·5
December ...	7	1	7·0	6	1	6·0	14	4	3·5	15	2	7·5	102	12	8·5	339	36	9·4	785	67	11·7	2,068	143	14·5
Year ...	1,747	140	12·5	1,679	164	10·2	2,047	249	8·2	17,481	1,208	14·5	17,344	1,229	14·1	10,463	961	10·9	13,843	1,113	12·4	12,740	967	13·2

Extent of Cloudy Sky, 1888.

TABLE XVII.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	10·0		0·8	4·6	2·0	1·0	9·6	10·0	8·2	3·4	6·6	0·2
2	10·0	0·4	0·6	1·0	0·2	0·6	9·6	10·0	4·4	6·0	7·2	1·6
3	9·8		1·4		1·2	2·2	10·0	10·0	0·8	5·4	8·2	4·0
4	8·0	1·0	0·4			2·2	10·0	9·4	1·8	2·4	9·0	4·2
5		2·4	0·2			4·4	10·0	8·6	3·2	0·8	8·8	2·4
6		2·0				7·8	10·0	9·8	5·2	0·6	8·6	4·6
7		5·2				9·2	9·8	9·4	6·4	0·2	7·4	0·4
8		0·6	0·2			7·2	10·0	6·2	6·8	0·6	8·4	
9					0·8	8·0	10·0	5·8	9·6		8·0	
10	0·2		0·4	0·8	1·0	3·4	9·2	7·6	5·2		7·2	
11			0·2	0·4	0·2	6·6	8·4	9·0	9·4		1·8	
12		1·2	0·6	2·6	3·0	8·0	9·4	9·8	7·4		2·2	
13	2·2	2·0	0·6	1·6	4·2	6·4	10·0	10·0	7·2		0·2	0·4
14		1·2	0·8	3·6	0·8	4·6	10·0	9·8	4·6	0·4	0·4	
15			1·2	0·6	2·2	9·0	10·0	7·6	4·4	1·0		
16	0·4		2·4	0·2	2·2	9·4	9·6	9·8	5·2	1·6		
17			2·2	2·8	1·8	5·8	6·8	9·6	8·4	4·2	3·8	1·0
18			1·0	5·8	3·4	5·8	7·6	10·0	6·2	1·0	1·8	0·4
19		1·4	4·0	4·8	2·2	3·6	8·4	10·0	8·0	2·2	3·0	0·6
20		0·6	2·8	0·6	3·0	3·8	10·0	10·0	2·0		1·4	0·4
21		0·2	2·0	0·6	1·0	10·0	10·0	9·8	5·6		0·4	
22	2·2	0·6	5·2	0·6	4·0	9·6	10·0	9·8	4·6	1·6		0·4
23		0·2	1·6	1·2	5·4	7·2	9·6	10·0	3·8	5·2		1·0
24		1·8	2·4	1·8	2·4	1·8	9·4	10·0	8·0	0·2		0·2
25	0·8	1·4	2·2	1·4	1·6	6·0	9·6	10·0	8·2	2·2	0·2	
26	3·4	1·0	3·8		2·0	9·0	10·0	9·0	6·8	3·6	0·6	0·2
27	2·8	0·8	1·0	1·8	2·8	9·0	9·2	9·2	6·4	4·4	0·6	
28	0·8			0·6	2·2	10·0	9·4	9·6	1·0	1·0	0·4	3·4
29		1·2	2·2	2·2	4·4	10·0	9·4	9·2	4·8	3·0	0·2	0·2
30			0·8	0·8	1·4	10·0	10·0	9·6	5·6	3·2	1·2	
31					1·0		10·0	9·8		3·0		
Monthly Mean.	1·6	0·8	1·4	1·3	1·8	6·4	9·5	9·3	5·6	1·8	3·3	0·8
Annual Variation.	—2·0	—2·8	—2·2	—2·3	—1·8	+2·8	+5·9	+5·7	+2·0	—1·8	—0·3	—2·8

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·5

Mean of the months from May to October ... ... 5·7

Mean for the year ... ... 3·6

Rainfall, 1888.

TABLE XVIII.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1888. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December
	in.	in.	in.			in.	in.	in.	in.	in.	in.	
1	0·03						2·63	1·02	0·04			
2	0·01						1·02	**2·89**	0·02			
3	0·18						0·17	0·47	0·01	0·11		
4	**1·63**					0·01	0·86	0·34			0·25	
5						0·22	2·60	0·16			0·19	
6						0·35	0·38	0·15			**0·33**	
7						1·62	0·07	0·32	0·03		0·10	
8						1·29		0·09			0·26	
9								0·35	0·06		0·01	
10						0·06	0·04	0·62	0·01		0·02	
11							0·29	0·53	**4·23**			
12						0·13	0·46	0·52	0·11			
13		0·02				0·09	2·03	0·10				
14						0·14	**4·66**	0·31				
15						0·10	1·69	0·19				
16						0·23	2·39	0·29				
17							0·44	0·05				
18						0·20	0·09	0·08	0·01			
19							0·10	0·14				
20							0·23	0·88				
21						0·34	0·19	0·05	0·10			
22						1·92	0·13	0·02	0·05			
23			0·10			0·13	0·23	0·29	0·23			
24							0·09	0·83	0·01			
25						0·27	0·47	0·34				
26						0·84	0·06	0·04				
27						0·13		0·03				
28						1·88	0·14	0·02				
29						**3·06**	0·11	0·23	0·01			
30						2·75	0·41	0·08				
31							0·49					
Monthly Total...	1·85	0·02	0·10			15·76	**22·47**	11·43	4·92	0·11	1·16	
Number of rainy days...	4	1	1			21	28	**30**	14	1	7	

Total fall of rain in the year ... ... 57·82 inches.
Total number of rainy days in the year 107
The greatest daily fall of rain in the year (that of 14th July) was ... ... 4·66 inches.
No rain fell in the months of April, May, and December, nor on any of the days left blank in the above table.

Extent of Cloudy Sky, 1889.

TABLE XIX.—*Means of Estimations made at 6, 10, 14, 16 and 22 hours daily, the whole Sky being reckoned as 10.*

1889.	MONTH.											
Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1			1·0		3·4	3·6	**4·6**	8·0	6·6	7·8		2·6
2			1·6		1·0	7·2	5·2	7·4	4·8	6·2		0·4
3	0·2	0·2		1·2	**0·2**	6·2	8·0	7·4	5·6	6·2		
4	0·2		0·6	1·0	2·0	8·4	9·8	**5·6**	**4·0**	9·0		
5	0·6		0·6	0·8	1·8	**10·0**	**10·0**	8·0	5·8	7·0		
6	0·2		2·4	0·2	0·6	10·0	10·0	**10·0**	4·8	**9·8**		
7			0·8		4·6	7·0	9·4	10·0	4·8	5·6		
8	1·4	0·2	0·4		2·6	6·0	9·8	6·6	6·0	3·6		
9	1·8	1·2		1·4	3·6	10·0	9·8	7·8	9·0	6·2		
10		1·6	0·8		2·4	8·2	10·0	10·0	6·8	3·2	0·2	
11		3·4	1·2		2·4	**8·4**	10·0	9·8	6·4	3·0		0·2
12		3·6	0·8		6·4	4·4	10·0	10·0	7·4	5·8		2·6
13	0·8	0·2	4·0		7·4	6·8	9·8	9·8	9·4	4·0		3·0
14				0·8	2·6	7·8	9·2	9·6	7·8	8·0		2·4
15			4·6	1·4	3·4	6·4	9·6	10·0	6·2	8·0		1·4
16			3·0	4·6	0·6	3·6	9·8	9·4	5·8	4·0	**1·2**	0·2
17	**4·2**	2·2	5·6	5·0	3·8	5·0	10·0	10·0	6·4	6·8	0·4	1·8
18	2·2		0·2	0·2	4·6	7·2	10·0	9·8	7·8	9·8		5·0
19	0·2		6·4	5·6	1·6	10·0	10·0	10·0	7·6	7·2		**6·2**
20		0·8	1·4	**7·4**	4·4	9·4	8·8	8·8	8·0	3·6	0·4	
21		0·8		5·4	1·4	5·0	9·6	9·0	7·8	4·8		
22	0·6	**4·4**	0·6	3·2	3·6	7·0	6·2	9·0	6·2	3·2		
23		2·8	2·8	2·2	2·8	4·6	5·8	9·6	9·2	2·2		
24		1·0	4·2	1·4	3·6	9·0	9·2	7·8	5·0	4·8	0·2	
25		0·2	4·6	1·6	2·2	10·0	8·4	10·0	6·4	4·4	0·6	
26			0·2	1·4	0·8	10·0	8·2	8·2	9·0	4·2		
27	0·2	0·6	4·0	2·2	1·8	10·0	7·4	9·2	9·2	2·4		
28		0·2	**9·8**	5·8	2·6	10·0	6·2	8·0	8·6	0·4		0·4
29			8·0	3·4	**8·6**	5·6	8·2	7·2	8·4			0·4
30	2·4		0·2	1·4	7·6	6·8	6·4	8·8	**9·6**			0·2
31	0·6		0·4		4·0		7·4	8·0		0·6		
Monthly Mean .	0·5	0·8	2·3	1·9	3·2	7·3	8·6	**8·8**	7·0	4·9	**0·1**	0·9
Annual Variation	—3·4	—3·1	—1·6	—2·0	—0·7	+3·4	+4·7	+4·9	+3·1	+1·0	—3·8	—3·0

For the days which have no entry, 0·0 is to be understood.

Mean of the months from January to April, November and December ... ... 1·1

Mean of the months from May to October ... ... 6·6

Mean for the year ... ... 3·9

Rainfall, 1889.

TABLE XX.—*Total Fall of Rain (in inches) as measured by Newman's Gauge, placed 4½ feet above the ground.*

1889. Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
					in.	in.	in.	in.	in.	in.		
1							0·01	0·08	0·26	0·05		
2						0·05		0·31	0·40			
3							1·14	0·01	0·15			
4							1·24	0·46		0·12		
5						0·02	2·21	0·22		0·58		
6						3·31	0·47	0·18		2·32		
7						2·54	0·52	1·58				
8						0·24	4·04	0·33				
9						0·99	2·02	0·11				
10						0·09	1·35	0·12				
11						0·02	2·68	0·63				
12						0·51	3·04	0·11				
13						0·03	1·26	1·06	0·08			
14						0·39	0·09	1·06	0·01			
15						0·22	0·04	0·78	0·11	0·10		
16						0·15	0·57	0·08	0·23			
17							1·21	0·06	0·83	0·45		
18							3·63	0·36		0·18		
19						0·04	3·54	0·59				
20						0·70	0·44	0·22				
21						0·28	0·32	0·09				
22						0·34	0·08	0·52				
23						0·17	0·14	0·02	0·10			
24						0·32	0·19	0·14				
25						3·32		0·17				
26					0·67	3·57	0·04	0·04				
27						1·30	0·02	0·62	0·07			
28						1·06		0·10	0·15			
29						0·23	0·15	0·19	0·04			
30							0·01	0·02	0·28			
31								0·06				
Monthly Total.					0·67	19·89	30·45	10·32	2·71	3·80		
Number of rainy days					1	24	27	31	13	7		

Total fall of rain in the year ... ... 67·84 inches.
Total number of rainy days in the year 103
The greatest daily fall of rain in the year (that of 8th July) was ... ... 4·04 inches.
No rain fell in the months of January, February, March, April, November and December, nor on any of the days left blank in the above table.

Maxima and Minima of different Meteorological Elements, 1888 and 1889.

TABLES XXI AND XXII.—*In which are collected the individual observations in each month of the year, which showed the greatest and the least values of the following elements, viz., Height of Barometer corrected for Temperature; Temperature of Air; Pressure of Vapour; and Additional Capacity of Air.*

	Month	Height of Barometer.			Temperature of Air.			Pressure of Vapour.			Additional Capacity.		
		Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.	Greatest.	Least.	Range.
		in.	in.	in.	°	°	°	in.	in.	in.	in.	in.	in.
Table XXI., 1888.	January ...	30·130	29·747	0·383	84·5	65·7	18·8	0·774	0·371	0·403	0·704	0·047	0·657
	February .	·126	·819	·307	84·1	66·6	17·5	·857	·357	·500	·596	·082	·514
	March ...	·072	·764	·308	92·9	72·9	20·0	·992	·488	·504	·850	·088	·762
	April ...	29·939	·682	·257	89·0	75·9	13·1	·958	·550	·408	·812	·119	·693
	May ...	·912	·612	·300	90·2	76·5	13·7	1·067	·600	·467	·635	·121	·514
	June ...	·774	·537	·237	90·6	75·0	15·6	·038	·782	·256	·488	·049	·439
	July ...	·778	·548	·230	85·8	74·4	11·4	·031	·736	·295	·302	·046	·256
	August ...	·850	·600	·250	84·7	75·6	9·1	0·962	·762	·200	·280	·048	·232
	September.	30·017	·659	·358	86·0	75·7	10·3	·995	·744	·251	·386	·053	·333
	October ...	29·991	·729	·262	93·8	75·4	18·4	·999	·601	·398	·858	·057	·801
	November.	30·030	·700	·330	93·4	72·1	21·3	·981	·376	·605	·866	·081	·785
	December .	·118	·846	·272	89·4	68·6	20·8	·875	·370	·505	·865	·083	·782
	Year ...	30·130	29·537	0·593	93·8	65·7	28·1	1·067	0·357	0·710	0·866	0·046	0·820
Table XXII., 1889.	January ...	30·093	29·873	0·220	88·5	65·7	22·8	0·845	0·329	0·516	0·851	0·075	0·776
	February .	·094	·821	·273	88·0	66·9	21·1	·804	·357	·447	·925	·078	·847
	March ...	·096	·759	·337	92·1	71·1	21·0	·892	·480	·412	·860	·078	·782
	April ...	29·978	·665	·313	89·4	74·0	15·4	·980	·626	·354	·695	·079	·616
	May ...	·930	·622	·291	91·2	76·7	14·5	1·028	·762	·266	·534	·108	·426
	June ...	·800	·394	·406	91·9	76·0	15·9	·043	·785	·258	·508	·033	·475
	July ...	·765	·453	·312	87·0	76·3	10·7	0·999	·800	·199	·347	·042	·305
	August ...	·878	·518	·360	86·1	76·5	9·6	·982	·778	·204	·357	·068	·289
	September.	·905	·525	·380	88·2	75·7	12·5	1·050	·736	·314	·395	·058	·337
	October ...	·992	·553	·439	91·6	71·5	20·1	·017	·553	·464	·796	·049	·747
	November.	30·015	·743	·272	88·5	68·0	20·5	0·829	·404	·425	·848	·065	·783
	December.	·066	·815	·251	86·1	67·6	18·5	·863	·332	·531	·914	·078	·836
	Year ...	30·096	29·394	0·702	92·1	65·7	26·4	1·050	0·329	0·721	0·925	0·033	0·892

Temperature of the Ground, 1888 and 1889.

TABLES XXIII AND XXIV.—*Showing, for each Month, the Mean Temperature of the Ground, and its Annual Variation, at the respective depths of 1, 9, 20, 60 and 132 inches below the surface.*

	Depth.	1 Inch.		9 Inches.		20 Inches.		60 Inches.		132 Inches.	
	Month.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.	Mean Temperature.	Excess over the yearly Mean.
Table XXIII., 1888.		°	°	°	°	°	°	°	°	°	°
	January ...	**76·2**	—6·0	**77·0**	—5·0	80·0	—3·7	82·1	—2·0	81·9	—1·2
	February ...	77·9	—4·3	77·7	—4·3	**79·4**	—4·3	**81·3**	—2·8	81·6	—1·5
	March	81·8	—0·4	80·9	—1·1	81·5	—2·2	81·6	—2·5	**81·4**	—1·7
	April	84·6	+2·4	83·5	+1·5	84·1	+0·4	83·2	—0·9	81·9	—1·2
	May	**86·3**	+4·1	85·1	+3·1	85·7	+2·0	84·9	+0·8	82·8	—0·3
	June	85·0	+2·8	**85·2**	+3·2	**87·0**	+3·3	86·2	+2·1	83·7	+0·6
	July	82·7	+0·5	83·3	+1·3	85·6	+1·9	**86·3**	+2·2	**84·4**	+1·3
	August... ...	81·4	—0·8	82·1	+0·1	84·3	+0·6	85·0	+0·9	84·2	+1·1
	September ...	82·9	+0·7	82·5	+0·5	84·2	+0·5	84·4	+0·3	83·9	+0·8
	October ...	84·8	+2·6	83·7	+1·7	84·8	+1·1	84·6	+0·5	83·7	+0·6
	November ...	83·1	+0·9	82·9	+0·9	85·2	+1·5	85·2	+1·1	83·7	+0·6
	December ...	79·8	—2·4	80·0	—2·0	83·2	—0·5	84·7	+0 6	83·6	+0·5
	Year ...	82·2		82·0		83·7		84·1		83·1	
Table XXIV., 1889.	January ...	77·9	—3·9	78·2	—3·6	81·3	—2·4	83·5	—1·0	83·3	—0·5
	February ...	78·2	—3·6	78·2	—3·6	80·6	—3·1	**82·8**	—1·7	82·8	—1·0
	March	81·4	—0·4	80·7	—1·1	82·1	—1·6	82·8	—1·7	**82·6**	—1·2
	April	84·3	+2·5	83·3	+1·5	84·0	+0·3	83·8	—0·7	82·9	—0·9
	May	**87·7**	+5·9	**86·3**	+4·5	86·7	+3·0	85·4	+0·9	83·7	—0·1
	June	85·1	+3·3	85·5	+3·7	**87·5**	+3·8	**86·9**	+2·4	84·5	+0·7
	July	82·7	+0·9	83·3	+1·5	85·6	+1·9	86·4	+1·9	**85·0**	+1·2
	August... ...	82·7	+0·9	83·1	+1·3	85·0	+1·3	85·5	+1·0	85·0	+1·2
	September ...	83·8	+2·0	83·6	+1·8	84·9	+1·2	85·0	+0·5	84·7	+0·9
	October ...	82·1	+0·3	82·4	+0·6	84·7	+1·0	85·1	+0·6	84·4	+0·6
	November ...	78·6	—3·2	79·1	—2·7	82·2	—1·5	84·3	—0·2	84·0	+0·2
	December ...	**77·3**	—4·5	**77·4**	—4·4	**80·4**	—3·3	83·1	1·4	83·3	—0·5
	Year ...	81·8		81·8		83·7		84·5		83·8	

Table XXV.—Five-day Means, 1888.

Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric Pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles.
1 ...	29·944	73·2	0·671	0·149	1·85	3·3 N.	6·8 E.	38 ...	29·650	81·9	0·941	0·149	3·05	6·8 S.	14·5 W.
2 ...	30·038	75·6	·620	·271		6·7 N.	3·3 E.	39 ...	·656	80·7	·895	·156	7·48	0·6 S.	17·8 W.
3 ...	29·947	73·6	·577	·255		7·1 N.	1·0 W.	40 ...	·669	80·5	·892	·150	4·71	7·4 S.	20·3 W.
4 ...	·957	74·9	·656	·213		6·7 N.	1·0 W.	41 ...	·709	81·5	·913	·163	0·87	4·6 S.	20·4 W.
5 ...	·974	74·4	·639	·216		3·4 N.	1·4 W.	42 ...	·715	81·6	·886	·196	0·78	8·0 S.	19·9 W.
6 ...	·983	72·9	·539	·274		6·8 N.	1·3 W.	43 ...	·693	78·6	·866	·111	5·28	1·5 S.	15·3 W.
7 ...	30·009	76·0	·696	·207		4·4 N.	1·4 W.	44 ...	·667	80·5	·879	·162	1·06	6·6 S.	16·4 W.
8 ...	·015	74·0	·564	·282		9·6 N.	3·2 W.	45 ...	·690	79·9	·865	·155	2·12	3·4 S.	18·6 W.
9 ...	29·928	74·1	·600	·247	0·02	2·9 N.	1·1 W.	46 ...	·732	79·9	·862	·158	0·92	4·3 S.	17·5 W.
10 ...	·909	76·1	·656	·246		8·3 N.	5·0 W.	47 ...	·693	79·8	·861	·156	1·38	8·6 S.	21·0 W.
11 ...	·922	76·8	·669	·256		7·8 N.	5·5 W.	48 ...	·779	79·2	·855	·143	1·26	3·6 S.	17·5 W.
12 ...	·931	77·7	·703	·252		7·6 N.	4·2 W.	49 ...	·792	80·1	·852	·177	0·37	0·9 S.	15·1 W
13 ...	·899	78·8	·757	·229		7·4 N.	5·5 W.	50 ...	·828	80·5	·819	·224	0·04	0·5 N.	4·5 W.
14 ...	·901	78·0	·736	·225		1·6 N.	5·1 W.	51 ...	·806	80·4	·857	·182	4·41	3·1 N.	4·4 W.
15 ...	·944	78·4	·702	·271		3·4 N.	5·6 W.	52 ...	·760	81·2	·867	·199		4·8 N.	9·7 W.
16 ...	·886	81·5	·803	·279		7·0 N.	5·5 W.	53 ...	·861	81·4	·888	·184	0·16	1·6 S.	5·9 W.
17 ...	·845	81·0	·829	·234	0·10	0·3 N.	4·6 W.	54 ...	·906	81·4	·864	·210	0·24	7·8 N.	4·2 W.
18 ...	·859	81·3	·802	·270		2·2 N.	4·5 W.	55 ...	·842	81·2	·835	·232	0·01	4·2 N.	3·8 W.
19 ...	·805	81·6	·769	·315		7·4 N.	6·5 W.	56 ...	·866	81·1	·892	·172	0·11	3·0 N.	2·6 W.
20 ...	·773	81·9	·824	·268		5·7 N.	6·7 W.	57 ...	·905	82·1	·837	·266		5·8 N.	1·5 W.
21 ...	·773	83·4	·826	·320		12·3 N.	8·0 W.	58 ...	·848	83·7	·848	·314		4·1 N.	0·2 W.
22 ...	·843	82·9	·878	·249		2·6 S.	5·7 W.	59 ...	·865	83·2	·780	·365		4·0 N.	1·4 E.
23 ...	·857	83·0	·858	·273		7·1 N.	8·3 W.	60 ...	·882	82·6	·803	·318		2·1 N.	1·5 E.
24 ...	·811	82·4	·867	·242		6·1 N.	8·5 W.	61 ...	·812	84·6	·852	·343		5·7 N.	0·8 E.
25 ...	·835	82·3	·765	·342		3·7 N.	7·4 W.	62 ...	·788	83·6	·872	·283	0·77	1·1 N.	1·4 E.
26 ...	·779	82·2	·788	·317		5·0 N.	7·4 W.	63 ...	·840	80·7	·858	·192	0·39	3·1 S.	1·5 E.
27 ...	·734	84·6	·929	·259		2·7 S.	7·0 W.	64 ...	·919	82·3	·797	·313		5·9 N.	0·5 E.
28 ...	·771	85·1	·875	·335		5·7 S.	9·3 W.	65 ...	·903	78·6	·622	·362		5·7 N.	1·8 E.
29 ...	·729	85·1	·929	·283		4·4 N.	9·6 W.	66 ...	·933	79·1	·686	·317		5·6 N.	1·1 E.
30 ...	·709	85·1	·920	·289		4·5 N.	9·4 W.	67 ..	·953	79·2	·711	·292		6·9 N.	1·2 W.
31 ...	·709	86·1	·935	·314	0·01	2·8 S.	6·3 W.	68 ...	·934	80·1	·701	·331		5·1 N.	2·4 E.
32 ...	·645	82·4	·925	·187	3·48	17·4 S.	1·5 W.	69 ..	·942	77·8	·655	·304		5·6 N.	0·3 E.
33 ...	·638	83·2	·941	·195	0·42	14·9 S.	1·0 W.	70 ...	·954	76·5	·560	·363		6·7 N.	3·9 E.
34 ...	·665	83·8	·957	·204	0·53	4·1 S.	8·8 W.	71 ...	30·006	77·7	·648	·309		5·6 N.	2·7 E.
35 ...	·686	82·5	·917	·196	2·39	6·9 S.	5·2 W.	72 ...	29·991	75·6	·607	·287		4·2 N.	1·0 E.
36 ...	·649	81·5	·924	·154	6·18	6·7 S.	9·2 W.	73 ...	·946	75·2	·593	·286		5·4 N.	0·1 E.
37 ...	·681	80·5	·910	·132	7·43	5·8 S.	18·6 W.								

*Five-day sums, not means.

TABLE XXVI.—Five-day Means, 1889.

Number of Five-day Period.	Barometric pressure.	Temperature of the Air.	Pressure of Vapour.	Additional capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.	Number of Five-day Period.	Barometric pressure.	Temperature of the Air.	Pressure of Vapour.	Additional Capacity of the Air.	Rainfall.*	North or South Component of Wind.	East or West Component of Wind.
	In.	°	In.	In.	In.	Miles.	Miles.		In.	°	In.	In.	In.	Miles.	Miles
1	29·966	75·6	0·611	0·282		4·3 N	1·0 E	38	29·656	79·4	0·898	0·107	9·26	6·4 S	6·6 W
2	**30·007**	77·6	·672	·281		4·7 N	0·1 W	39	·619	80·3	·921	·115	8·42	4·4 S	17·6 W
3	29·950	74·6	·607	·254		8·2 N	2·5 W	40	**·547**	79·7	·918	**·096**	8·99	4·3 S	15·8 W
4	·965	74·4	·556	·301		7·7 N	1·2 W	41	·681	81·3	·918	·152	1·17	6·6 S	15·2 W
5	·968	74·9	·616	·254		6·7 N	1·5 W	42	·678	82·4	·912	·195	0·21	2·2 S	13·7 W
6	·969	74·7	·652	·214		2·5 N	2·0 W	43	·686	82·4	·898	·210	0·41	4·2 S	12·1 W
7	·974	74·3	·573	·281		10·4 N	3·2 W	44	·625	81·5	·900	·177	2·77	2·0 S	17·4 W
8	·938	75·6	·663	·226		6·9 N	3·6 W	45	·733	81·3	·895	·174	2·03	0·3 S	19·0 W
9	·984	75·9	·588	·315		7·4 N	1·6 W	46	·669	80·4	·896	·143	2·34	6·5 S	18·9 W
10	·954	75·5	·601	·287		6·5 N	3·8 W	47	·725	80·6	·885	·159	1·44	3·1 S	**19·3 W**
11	·920	75·9	·633	·267		6·9 N	2·9 W	48	·684	80·7	·882	·165	1·07	1·4 S	13·8 W
12	·980	75·8	·662	·234		5·8 N	5·3 W	49	·810	81·2	·870	·196	0·93	2·2 N	10·5 W
13	30·004	78·7	·661	·333		8·1 N	2·6 W	50	·823	81·5	·846	·230	0·15	4·4 N	2·9 W
14	29·933	79·3	·755	·250		2·8 N	3·5 W	51	·775	81·6	·874	·208		7·0 N	4·5 W
15	·923	80·1	·812	·219		2·1 S	3·9 W	52	·682	81·8	·928	·160	1·26	1·6 N	0·1 E
16	·904	79·6	·721	·293		10·4 N	6·0 W	53	·651	83·6	·966	·188		1·5 N	4·9 W
17	·892	77·8	·681	·276		8·0 N	6·1 W	54	·746	82·4	·919	·188	0·17	5·8 N	1·4 W
18	·865	79·7	·771	·246		7·4 N	5·5 W	55	·819	79·6	·857	·154	0·52	4·9 S	2·5 W
19	·851	80·2	·802	·231		7·9 N	7·4 W	56	·788	80·1	·888	·143	3·02	1·8 S	0·5 E
20	·841	80·5	·745	·302		6·2 N	6·3 W	57	·799	82·5	·948	·163		3·4 N	2·6 W
21	·808	82·8	·815	·313		**11·2 N**	7·8 W	58	·704	83·3	·866	·278	0·55	5·2 N	1·2 E
22	·803	82 8	·891	·234		0·9 S	5·3 W	59	·742	79·3	·811	·192	0·18	4·5 N	0·6 W
23	·787	82·6	·859	·254		4·2 N	6·8 W	60	·877	77·1	·694	·241		1·9 N	1·1 E
24	·768	83·6	·895	·258		2·2 S	6·8 W	61	·902	78·3	·699	·278		6·5 N	2·0 E
25	·808	83·5	·874	·276		1·6 N	7·2 W	62	·893	77·7	·708	·247		5·8 N	1·9 E
26	·797	85·2	·971	·244		0·7 S	6·5 W	63	·911	76·0	·664	·237		6·7 N	0·0
27	·813	85·3	·921	·298		1·1 N	7·2 W	64	·897	75·4	·587	·302		6·5 N	3·6 E
28	·777	85·5	·935	·291		1·2 N	7·6 W	65	·830	75·6	·582	·311		8·3 N	1·8 E
29	·761	87·0	·934	**·351**		2·5 S	11·2 W	66	·844	75·7	·675	·220		4·8 N	0·1 E
30	·742	86·0	·946	·297	0·67	3·9 N	8·9 W	67	·922	74·5	·642	·216		7·1 N	0·7 W
31	·651	**87·1**	**·975**	·313	0·05	0·8 S	6·5 W	68	·928	**73·6**	·633	·199		7·5 N	1·1 W
32	·568	82·4	·928	·183	7·10	**18·6 S**	**9·2 E**	69	·906	75·2	·616	·266		6·1 N	2·6 E
33	·748	84·0	·974	·191	1·04	1·6 S	14·8 W	70	·980	73·6	**·522**	·314		5·4 N	3·4 E
34	·710	84·1	·947	·224	0·41	2·2 S	13·7 W	71	·943	74·4	·556	·303		6·0 N	3·3 E
35	·701	82·6	·907	·211	1·81	3·6 S	10·9 W	72	·915	73·9	·568	·275		5·4 N	2·3 E
36	·633	80·1	·912	·118	**9·48**	3·9 S	14·4 W	73	·917	77·3	·690	·253		5·5 N	0·3 W
37	·694	82·1	·917	·182	2·39	5·8 S	5·1 W								

*Five-day sums, *not means*.

TABLES OF RESULTS

OF

ABSOLUTE MAGNETICAL OBSERVATIONS

1888 AND 1889

s 203—1

Absolute Magnetical Observations.—Table I.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1888.

1888. Date.	Civil Time. Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JANUARY 4	12 7	2·8241	0·70	74·6	+9·4	16·86	75·1	17 40 27	8 58 47	73·9	16·81	75·1	P.	·64304	8·1234	8·1233	+·0001	8·1233		
,, ,,	15 7	2·8255	0·74	77·5	+9·4	16·42	76·0	17 40 35	8 58 42	75·1	16·67	75·3	P.	·64309	8·1201	8·1210	−·0009	8·1205		
,, 11	12 1	2·8257	0·95	81·4	+8·9	16·16	78·3	17 39 57	8 58 30	80·4	16·05	78·7	G.S.J.	·64341	8·1199	8·1199	·0000	8·1199		
,, ,,	15 18	2·8271	0·98	81·2	+8·9	15·29	80·0	17 39 55	8 58 30	81·6	15·64	79·2	G.S.J.	·64329	8·1148	8·1148	·0000	8·1148		
,, 18	12 5	2·8264	0·93	81·8	+8·8	15·76	79·8	17 40 12	8 58 37	82·1	15·65	80·1	P.	·64347	8·1160	8·1160	·0000	8·1160	8·1170	3·7426
,, ,,	15 9	2·8270	0·95	83·0	+8·8	15·06	81·2	17 40 30	8 58 42	82·8	15·44	80·7	P.	·64371	8·1133	8·1139	−·0006	8·1136		
,, 25	12 7	2·8268	0·91	83·0	+9·4	15·73	79·0	17 39 55	8 58 27	82·7	15·75	79·1	G.S.J.	·64346	8·1163	8·1165	−·0002	8·1164		
,, ,,	15 23	2·8276	0·93	81·9	+9·4	15·24	80·1	17 40 22	8 58 42	83·0	15·50	79·9	G.S.J.	·64346	8·1113	8·1113	·0000	8·1113		
FEBRUARY 1	12 2	2·8258	0·92	82·9	+9·2	16·17	78·8	17 39 42	8 58 17	84·9	16·04	79·1	P.	·64371	8·1178	8·1186	−·0008	8·1182		
,, ,,	15 7	2·8268	0·95	82·7	+9·2	15·39	81·1	17 40 0	8 58 22	85·3	15·62	80·5	P.	·64367	8·1132	8·1143	−·0011	8·1137		
,, 8	12 9	2·8245	0·92	79·8	+9·7	16·53	78·9	17 39 25	8 58 7	80·0	16·33	79·1	G.S.J.	·64331	8·1246	8·1255	−·0009	8·1250		
,, ,,	15 15	2·8262	0·93	80·4	+9·7	15·80	79·8	17 39 42	8 58 17	80·9	15·85	79·8	G.S.J.	·64322	8·1184	8·1190	−·0006	8·1187		
,, 15	12 0	2·8259	0·94	83·5	+9·2	16·20	80·1	17 38 7	8 57 32	82·9	16·12	80·3	V.G.G.	·64313	8·1259	8·1262	−·0003	8·1260	8·1211	3·7445
,, ,,	15 7	2·8266	0·93	83·0	+9·2	15·39	81·7	17 38 12	8 57 35	83·4	15·74	81·0	V.G.G.	·64315	8·1227	8·1231	−·0004	8·1229		
,, 22	12 19	2·8259	1·02	83·6	+8·8	15·95	79·9	17 38 32	8 57 47	84·2	15·76	80·6	G.S.J.	·64334	8·1229	8·1231	−·0002	8·1230		
,, ,,	15 22	2·8279	0·93	84·3	+8·8	15·16	82·5	17 38 32	8 57 50	85·6	15·49	81·6	G.S.J.	·64321	8·1167	8·1165	+·0002	8·1166		
,, 29	12 17	2·8256	0·90	86·8	+9·2	15·95	82·9	17 37 57	8 57 30	86·8	15·87	83·5	V.G.G.	·64371	8·1266	8·1266	·0000	8·1266		
,, ,,	15 16	2·8270	0·90	86·2	+9·2	15·28	84·9	17 38 5	8 57 35	87·7	15·33	84·6	V.G.G.	·64346	8·1206	8·1204	+·0002	8·1205		
MARCH 7	11 50	2·8259	0·83	85·5	+8·8	16·09	82·2	17 37 27	8 57 17	84·8	16·00	82·5	G.S.J.	·64325	8·1283	8·1281	+·0002	8·1282		
,, ,,	15 12	2·8267	0·73	83·3	+8·8	15·48	83·2	17 37 57	8 57 35	84·5	15·68	83·0	G.S.J.	·64318	8·1229	8·1223	+·0006	8·1226		
,, 15	12 5	2·8259	0·75	83·5	+8·5	16·09	83·0	17 37 50	8 57 30	83·8	15·94	83·2	V.G.G.	·64313	8·1262	8·1255	+·0007	8·1258		
,, ,,	15 10	2·8266	0·72	82·4	+8·5	15·33	83·5	17 38 45	8 57 55	83·3	15·42	83·5	V.G.G.	·64324	8·1206	8·1204	+·0002	8·1205	8·1232	3·7454
,, 21	11 59	2·8292	0·53	93·3	+7·7	15·18	86·4	17 36 17	8 56 32	91·9	14·97	87·0	G.S.J.	·64316	8·1240	8·1249	−·0009	8·1244		
,, ,,	15 18	2·8314	0·51	91·8	+7·7	14·06	88·9	17 36 37	8 56 40	92·7	14·45	88·4	G.S.J.	·64291	8·1145	8·1156	−·0011	8·1150		
,, 28	12 14	2·8280	0·55	88·4	+9·2	15·90	86·2	17 35 35	8 56 7	88·9	15·69	86·8	V.G.G.	·64264	8·1287	8·1302	−·0015	8·1294		
,, ,,	15 14	2·8300	0·57	88·8	+9·2	14·13	87·8	17 36 25	8 56 35	89·7	15·12	87·5	V.G.G.	·64306	8·1193	8·1204	−·0011	8·1198		

1888. Date.	Civil Time. Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 4	11 59	2·8294	0·47	88·7	+9·4	14·81	86·3	17 37 47	8 57 20	88·9	14·75	86·7	G. S. J.	·64312	8·1169	8·1176	−·0007	8·1172		
„ „	15 10	2·8296	0·43	87·1	+9·4	14·45	87·0	17 38 10	8 57 35	89·0	14·42	87·0	G. S. J.	·64310	8·1135	8·1137	−·0002	8·1136		
„ 11	12 10	2·8286	0·49	89·8	+8·9	15·55	86·4	17 36 30	8 56 47	90·4	15·17	86·9	V. G. G.	·64298	8·1234	8·1234	·0000	8·1234		
„ „	15 15	2·8298	0·48	88·1	+8·9	13·90	86·9	17 37 37	8 57 17	90·8	14·18	87·0	V. G. G.	·64322	8·1139	8·1143	−·0004	8·1141		
„ 18	12 5	2·8295	0·44	90·5	+8·4	14·78	87·1	17 36 55	8 56 52	90·9	14·61	87·4	G. S. J.	·64303	8·1195	8·1203	−·0008	8·1199	8·1184	3·7432
„ „	15 17	2·8302	0·40	89·8	+8·4	14·36	87·6	17 37 5	8 56 57	91·1	14·37	87·8	G. S. J.	·64297	8·1160	8·1169	−·0009	8·1164		
„ 25	12 8	2·8293	0·46	89·4	+8·4	14·86	86·5	17 36 35	8 56 40	89·4	14·75	87·0	V. G. G.	·64282	8·1216	8·1227	−·0011	8·1221		
„ „	15 15	2·8300	0·45	88·8	+8·4	14·43	87·7	17 36 15	8 56 32	89·7	14·63	87·6	V. G. G.	·64267	8·1201	8·1210	−·0009	8·1205		
May 2	12 15	2·8301	0·42	89·9	+9·3	14·81	86·4	17 36 30	8 56 37	89·9	14·73	86·7	G. S. J.	·64270	8·1197	8·1210	−·0013	8·1203		
„ „	15 26	2·8306	0·45	89·5	+9·3	14·37	87·7	17 37 10	8 56 55	90·8	14·39	87·1	G. S. J.	·64279	8·1147	8·1161	−·0014	8·1154		
„ 9	12 5	2·8292	0·46	89·1	+9·1	15·07	85·8	17 36 55	8 56 45	89·5	15·01	86·3	V. G. G.	·64294	8·1206	8·1223	−·0017	8·1214		
„ „	15 13	2·8303	0·46	89·0	+9·1	14·51	87·2	17 37 25	8 57 2	90·3	14·66	86·9	V. G. G.	·64295	8·1147	8·1161	−·0014	8·1154		
„ 16	12 15	2·8297	0·45	92·5	+8·4	14·98	88·4	17 35 47	8 56 15	93·1	14·77	88·9	G. S. J.	·64294	8·1227	8·1240	−·0013	8·1233		
„ „	15 19	2·8313	0·41	92·7	+8·4	14·17	89·8	17 35 50	8 56 17	94·3	14·42	89·6	G. S. J.	·64285	8·1169	8·1182	−·0013	8·1175	8·1185	3·7433
„ 23	12 18	2·8312	0·41	93·1	+9·1	14·33	89·4	17 36 7	8 56 27	93·8	14·23	89·9	G. S. J.	·64285	8·1173	8·1182	−·0009	8·1177		
„ „	15 28	2·8312	0·43	91·2	+9·1	13·98	90·2	17 36 20	8 56 32	93·8	14·07	90·1	G. S. J.	·64282	8·1147	8·1160	−·0013	8·1153		
„ 30	12 3	2·8303	0·44	93·9	+8·4	14·64	88·7	17 35 47	8 56 17	94·3	14·55	88·9	V. G. G.	·64303	8·1212	8·1221	−·0009	8·1216		
„ „	15 25	2·8313	0·43	93·0	+8·4	13·98	90·0	17 35 55	8 56 22	95·0	14·11	89·7	V. G. G.	·64289	8·1161	8·1173	−·0012	8·1167		
June 6	12 12	2·8304	0·38	91·0	+7·8	14·74	87·6	17 35 55	8 56 25	91·7	14·56	87·9	G. S. J.	·64264	8·1203	8·1208	−·0005	8·1205		
„ „	15 26	2·8318	0·38	90·0	+7·8	13·92	88·6	17 36 15	8 56 35	92·1	14·28	88·3	G. S. J.	·64260	8·1139	8·1145	−·0006	8·1142		
„ 13	12 41	2·8289	0·41	88·6	+7·3	15·65	85·6	17 35 47	8 56 20	89·0	15·45	85·9	V. G. G.	·64255	8·1255	8·1261	−·0006	8·1258		
„ „	15 7	2·8306	0·44	88·2	+7·3	14·73	86·0	17 35 57	8 56 27	90·6	15·18	85·9	V. G. G.	·64260	8·1180	8·1184	−·0004	8·1182		
„ 20	12 21	2·8297	0·39	92·9	+8·0	14·88	88·0	17 35 30	8 56 12	93·6	14·76	88·0	V. G. G.	·64294	8·1236	8·1244	−·0008	8·1240	8·1202	3·7441
„ „	15 26	2·8310	0·39	92·0	+8·0	14·24	88·9	17 35 40	8 56 17	94·2	14·43	88·7	V. G. G.	·64282	8·1180	8·1186	−·0006	8·1183		
„ 27	12 23	2·8300	0·33	90·0	+7·7	15·02	86·3	17 35 35	8 56 17	90·6	14·99	86·5	G. S. J.	·64255	8·1229	8·1233	−·0004	8·1231		
„ „	15 24	2·8310	0·35	88·6	+7·7	14·49	86·5	17 35 55	8 56 30	90·4	14·80	86·6	G. S. J.	·64250	8·1176	8·1176	·0000	8·1176		
July 4	12 13	2·8290	0·41	84·8	+8·0	15·42	83·5	17 37 40	8 57 22	84·4	15·12	83·3	V. G. G.	·64245	8·1193	8·1191	+·0002	8·1192		
„ „	15 16	2·8313	0·42	83·0	+8·0	14·74	83·2	17 37 50	8 57 22	84·7	14·90	83·3	V. G. G.	·64208	8·1100	8·1105	−·0005	8·1102		
„ 11	12 15	2·8292	0·34	88·6	+7·9	15·34	84·9	17 35 15	8 56 12	88·7	15·36	85·2	G. S. J.	·64247	8·1270	8·1268	+·0002	8·1269		
„ „	15 25	2·8305	0·36	88·1	+7·9	14·70	85·7	17 35 42	8 56 25	89·1	15·00	85·6	G. S. J.	·64241	8·1208	8·1206	+·0002	8·1207		
„ 18	12 12	2·8295	0·38	87·4	+8·3	15·41	84·1	17 35 37	8 56 25	87·4	15·31	84·1	V. G. G.	·64226	8·1247	8·1244	+·0003	8·1245	8·1195	3·7437
„ „	15 16	2·8310	0·35	87·2	+8·3	14·74	84·1	17 36 25	8 56 45	88·0	15·05	84·0	V. G. G.	·64236	8·1171	8·1169	+·0002	8·1170		
„ 25	12 7	2·8295	0·34	86·7	+8·9	15·13	83·9	17 36 47	8 56 57	86·4	14·98	84·0	G. S. J.	·64245	8·1210	8·1208	+·0002	8·1209		
„ „	15 24	2·8300	0·34	85·4	+8·9	14·7-	84·1	17 37 7	8 57 10	86·6	14·73	84·2	G. S. J.	·64245	8·1169	8·1163	+·0006	8·1166		

Aug.	1	12	12	2·8291	0·34	84·0	+8·7	15·62	82·0	17	36	50	8	57	2	84·6	15·56	82·1	V. G. G.	·64230	8·1212	8·1206	+·0006	8·1209		
,,	,,	15	18	2·8303	0·34	83·0	+8·7	15·08	81·8	17	37	27	8	57	20	83·5	15·26	82·0	V. G. G.	·64220	8·1158	8·1152	+·0006	8·1155		
,,	8	11	59	2·8295	0·30	86·2	+9·4	15·14	83·0	17	36	32	8	56	57	86·8	15·19	83·5	G. S. J.	·64255	8·1212	8·1201	+·0011	8·1206		
,,	,,	15	15	2·8306	0·35	86·9	+9·4	14·71	83·9	17	36	25	8	56	52	87·8	15·02	83·8	G. S. J.	·64247	8·1180	8·1171	+·0009	8·1175		
,,	15	12	15	2·8294	0·37	86·2	+9·0	15·84	82·2	17	36	22	8	56	47	85·9	15·68	82·6	V. G. G.	·64232	8·1229	8·1223	+·0006	8·1226	8·1190	3·7435
,,	,,	15	15	2·8306	0·36	86·3	+9·0	15·11	83·3	17	36	35	8	56	52	87·0	15·35	83·0	V. G. G.	·64233	8·1176	8·1173	+·0003	8·1174		
,,	22	12	0	2·8303	0·30	85·8	+8·7	15·17	82·4	17	37	7	8	57	7	86·1	15·15	82·7	G. S. J.	·64238	8·1171	8·1167	+·0004	8·1169		
,,	,,	15	15	2·8305	0·34	85·0	+8·7	14·72	83·0	17	37	17	8	57	15	86·4	14·89	83·0	G. S. J.	·64244	8·1148	8·1143	+·0005	8·1145		
,,	30	12	16	2·8298	0·34	86·3	+9·4	15·62	82·6	17	35	57	8	56	30	86·4	15·53	83·0	V. G. G.	·64216	8·1227	8·1229	−·0002	8·1228		
,,	,,	15	18	2·8304	0·35	85·9	+9·4	15·18	83·4	17	35	35	8	56	20	87·4	15·47	83·4	V. G. G.	·64213	8·1212	8·1212	·0000	8·1212		
Sept.	5	12	15	2·8300	0·34	88·5	+9·8	15·10	83·9	17	36	5	8	56	37	88·4	15·04	84·1	G. S. J.	·64247	8·1219	8·1216	+·0003	8·1217		
,,	,,	15	14	2·8305	0·32	87·9	+9·8	14·80	84·5	17	36	10	8	56	42	89·1	14·88	84·4	G. S. J.	·64245	8·1191	8·1186	+·0005	8·1188		
,,	12	12	17	2·8297	0·32	88·1	+9·2	15·41	83·9	17	35	47	8	56	30	88·0	15·27	84·1	V. G. G.	·64236	8·1240	8·1234	+·0006	8·1237		
,,	,,	15	17	2·8307	0·33	86·1	+9·2	14·55	84·7	17	36	10	8	56	40	88·8	14·88	84·7	V. G. G.	·64238	8·1173	8·1169	+·0004	8·1171	8·1195	3·7437
,,	19	12	13	2·8305	0·35	89·8	+9·8	14·95	85·1	17	35	32	8	56	20	89·6	14·97	85·4	G. S. J.	·64241	8·1227	8·1223	+·0004	8·1225		
,,	,,	15	26	2·8312	0·35	88·7	+9·8	14·24	85·8	17	35	32	8	56	17	90·2	14·80	85·7	G. S. J.	·64239	8·1191	8·1191	·0000	8·1191		
,,	26	12	12	2·8307	0·36	88·0	+8·8	14·96	84·7	17	36	17	8	56	45	88·3	14·81	84·9	V. G. G.	·64229	8·1190	8·1184	+·0006	8·1187		
,,	,,	15	18	2·8311	0·36	87·3	+8·8	14·28	85·4	17	36	45	8	57	0	88·9	14·34	85·2	V. G. G.	·64239	8·1147	8·1139	+·0008	8·1143		
Oct.	3	12	10	2·8300	0·32	88·3	+10·3	15·38	84·7	17	35	47	8	56	30	87·9	15·19	85·0	G. S. J.	·64229	8·1233	8·1227	+·0006	8·1230		
,,	,,	15	19	2·8301	0·33	87·4	+10·3	14·70	85·5	17	36	0	8	56	40	88·4	14·86	85·3	G. S. J.	·64245	8·1212	8·1201	+·0011	8·1206		
,,	10	12	13	2·8302	0·32	90·2	+ 9·7	15·35	84·4	17	34	55	8	56	0	90·6	15·23	84·8	V. G. G.	·64233	8·1251	8·1251	·0000	8·1251		
,,	,,	15	17	2·8300	0·33	92·0	+ 9·7	14·89	86·5	17	35	37	8	56	25	93·9	14·89	85·7	V. G. G.	·64294	8·1216	8·1210	+·0006	8·1213		
,,	17	12	13	2·8313	0·34	93·2	+10·2	14·69	87·7	17	34	52	8	55	57	93·1	14·55	88·0	G. S. J.	·64244	8·1223	8·1225	−·0002	8·1224	8·1210	3·7444
,,	,,	15	16	2·8315	0·36	91·4	+10·2	14·20	89·4	17	35	12	8	56	10	94·1	14·41	88·9	G. S. J.	·64255	8·1180	8·1178	+·0002	8·1179		
,,	24	12	20	2·8311	0·31	91·9	+10·8	15·10	86·5	17	34	40	8	55	50	92·1	14·90	86·9	V. G. G.	·64223	8·1236	8·1238	−·0002	8·1237		
,,	,,	15	15	2·8320	0·32	92·1	+10·8	14·05	88·9	17	35	0	8	56	7	94·5	14·49	87·9	V. G. G.	·64257	8·1178	8·1173	+·0005	8·1175		
,,	31	12	5	2·8321	0·38	94·3	+ 9·9	14·45	88·3	17	34	42	8	55	50	94·7	14·29	88·8	G. S. J.	·64239	8·1201	8·1204	−·0003	8·1202		
,,	,,	15	13	2·8319	0·37	92·8	+ 9·9	14·05	90·4	17	34	47	8	55	57	95·1	14·12	90·0	G. S. J.	·64244	8·1188	8·1186	+·0002	8·1187		
Nov.	7	12	18	2·8322	0·37	92·0	+ 9·2	14·58	86·1	17	36	0	8	56	25	91·1	14·48	86·6	V. G. G.	·64235	8·1165	8·1175	−·0010	8·1170		
,,	,,	15	15	2·8327	0·35	86·0	+ 9·2	13·87	86·8	17	36	10	8	56	30	91·8	14·21	86·9	V. G. G.	·64208	8·1085	8·1094	−·0009	8·1089		
,,	14	12	12	2·8318	0·37	92·3	+10·0	15·00	86·7	17	34	27	8	55	47	92·8	14·86	87·1	G. S. J.	·64214	8·1221	8·1219	+·0002	8·1220		
,,	,,	15	15	2·8327	0·40	92·5	+10·0	14·26	88·7	17	34	27	8	55	50	94·2	14·51	88·1	G. S. J.	·64217	8·1182	8·1176	+·0006	8·1179	8·1147	3·7415
,,	21	12	14	2·8316	0·39	87·8	+11·4	15·45	83·1	17	36	52	8	57	0	87·9	15·24	83·3	V. G. G.	·64218	8·1145	8·1141	+·0004	8·1143		
,,	,,	15	15	2·8328	0·38	86·0	+11·4	14·75	84·9	17	36	57	8	57	5	87·9	15·03	84·4	V. G. G.	·64202	8·1090	8·1085	+·0005	8·1087		
,,	28	12	5	2·8311	0·50	89·3	+10·5	15·44	84·2	17	36	35	8	56	50	88·8	15·21	84·7	G. S. J.	·64236	8·1171	8·1169	+·0002	8·1170		
,,	,,	15	13	2·8320	0·47	87·1	+10·5	14·74	85·9	17	36	45	8	56	55	88·9	14·83	85·4	G. S. J.	·64216	8·1120	8·1119	+·0001	8·1119		
Dec.	5	12	31	2·8309	0·47	88·3	+10·0	15·50	84·1	17	35	40	8	56	27	89·3	15·32	84·3	V. G. G.	·64214	8·1197	8·1191	+·0006	8·1194		
,,	,,	15	12	2·8322	0·47	87·5	+10·0	14·75	85·5	17	36	2	8	56	37	91·2	15·03	85·3	V. G. G.	·64223	8·1122	8·1117	+·0005	8·1119		
,,	12	12	13	2·8304	0·56	86·2	+11·7	15·93	81·5	17	36	5	8	56	35	86·5	15·81	81·7	G. S. J.	·64202	8·1203	8·1201	+·0002	8·1202		
,,	,,	15	18	2·8305	0·59	84·3	+11·7	15·37	83·6	17	36	30	8	56	45	86·9	15·57	82·8	G. S. J.	·64210	8·1165	8·1167	−·0002	8·1166		
,,	19	12	12	2·8297	0·57	89·0	+10·5	15·81	83·1	17	34	52	8	56	0	89·3	15·73	83·6	V. G. G.	·64226	8·1266	8·1264	+·0002	8·1265	8·1189	3·7435
,,	,,	15	17	2·8309	0·59	87·8	+10·5	14·94	85·5	17	35	0	8	56	2	91·1	15·27	84·9	V. G. G.	·64218	8·1199	8·1199	·0000	8·1199		
,,	26	12	0	2·8309	0·53	86·1	+11·5	16·17	80·6	17	35	37	8	56	25	87·2	16·05	81·0	C.	·64186	8·1199	8·1195	+·0004	8·1197		
,,	,,	14	54	2·8312	0·57	86·6	+11·5	15·70	82·2	17	35	57	8	56	40	87·5	15·86	81·7	C.	·64204	8·1178	8·1167	+·0011	8·1172		

The mean value of the Horizontal Force for the year 1888 = 8·1192 | 3·7436

Absolute Magnetical Observations.—Table II.

Observations of Absolute Declination.

1888.

1888. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Mean Readings. Collimator Magnet. Scale apparently Inverted.	Mean Readings. Horizontal Circle with Telescope pointed to Scale of Collimator Magnet.	Mean Readings. Horizontal Circle with Telescope pointed to Tárdeo Chimney.	Torsion. Mean.	Torsion. Effect of 90°.	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Monthly Mean. Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 5	11 27	+1·52	+1·57	17 18 5	196 53 5	0		P.	36.20	0 51 23		
„ 12	11 16	+1·55	+1·51	17 18 50	196 52 40	10 E	0·84	G.S.J.	36·34	0 52 26	36·14	0 51 1
„ 19	11 33	+1·52	+1·67	17 16 10	196 52 40	0		P.	35·95	0 49 46		
„ 26	11 25	+1·52	+1·60	17 16 35	196 52 25	0		G.S.J.	36·08	0 50 30		
FEB. 2	11 32	+1·55	+1·60	17 16 30	196 52 40	0		P.	36·00	0 50 13		
„ 9	11 31	+1·57	+1·47	17 17 30	196 52 40	0		G.S.J.	36·15	0 51 23	36·09	0 51 4
„ 16	11 15	+1·52	+1·60	17 17 10	196 52 25	0		V.G.G.	36·08	0 51 5		
„ 23	11 29	+1·50	+1·65	17 18 0	196 52 25	15 E	0·81	G.S.J.	36·14	0 51 36		
MARCH 1	11 29	+1·52	+1·64	17 17 50	196 52 15	0		V.G.G.	36·16	0 51 53		
„ 8	11 23	+1·52	+1·65	17 17 10	196 51 55	0		G.S.J.	36·12	0 51 33		
„ 16	11 22	+1·54	+1·62	17 18 0	196 51 50	0		V.G.G.	36·28	0 52 30	36·11	0 51 27
„ 22	11 19	+1·40	+1·75	17 16 50	196 52 5	0		G.S.J.	36·01	0 50 48		
„ 29	11 43	+1·52	+1·64	17 16 35	196 52 20	0		V.G.G.	35·96	0 50 33		
APRIL 5	11 21	+1·51	+1·70	17 16 0	196 52 15	0		G.S.J.	35·91	0 49 59		
„ 12	11 25	+1·55	+1·55	17 16 40	196 51 50	0		V.G.G.	36·08	0 51 16	35·94	0 50 16
„ 19	11 22	+1·45	+1·72	17 15 30	196 51 50	0		G.S.J.	35·88	0 49 48		
„ 26	11 32	+1·52	+1·59	17 15 30	196 51 50	0		V.G.G.	35·90	0 50 2		
MAY 3	11 29	+1·51	+1·59	17 15 40	196 51 30	0		G.S.J.	36·00	0 50 30		
„ 10	11 38	+1·46	+1·70	17 15 10	196 51 45	0		G.S.J.	35·87	0 49 34		
„ 17	11 37	+1·59	+1·49	17 14 20	196 51 40	0		V.G.G.	35·83	0 49 13	35·95	0 49 56
„ 25	11 28	+1·52	+1·56	17 16 0	196 52 0	0		G.S.J.	36·03	0 50 23		
„ 31	11 29	+1·52	+1·59	17 15 40	196 52 0	0		V.G.G.	36·00	0 50 2		
JUNE 7	11 29	+1·50	+1·64	17 16 0	196 52 5	0		G.S.J.	36·05	0 50 11		
„ 14	11 33	+1·52	+1·64	17 15 35	196 52 0	0		V.G.G.	35·99	0 49 53	36·00	0 50 0
„ 21	11 35	+1·51	+1·67	17 15 40	196 52 5	0		V.G.G.	35·97	0 49 50		
„ 28	11 29	+1·49	+1·70	17 16 10	196 52 15	0		G.S.J.	36·00	0 50 7		
JULY 5	11 34	+1·51	+1·64	17 15 0	196 52 35	0		V.G.G.	35·78	0 48 43		
„ 12	11 22	+1·51	+1·67	17 14 20	196 51 50	0		G.S.J.	35·80	0 48 45	35·85	0 49 15
„ 19	11 36	+1·51	+1·62	17 14 40	196 52 5	0		V.G.G.	35·80	0 48 54		
„ 26	11 25	+1·44	+1·75	17 17 40	196 53 5	0		G.S.J.	36·04	0 50 40		
AUG. 2	11 34	+1·54	+1·61	17 16 40	196 53 5	0		V.G.G.	35·93	0 49 57		
„ 10	11 19	+1·50	+1·62	17 14 5	196 52 5	0		G.S.J.	35·71	0 48 18		
„ 16	11 36	+1·59	+1·46	17 14 35	196 51 50	0		V.G.G.	35·88	0 49 19	35·85	0 49 10
„ 23	11 32	+1·52	+1·66	17 14 40	196 51 45	0		G.S.J.	35·87	0 49 11		
„ 31	11 34	+1·50	+1·66	17 14 40	196 51 50	0		V.G.G.	35·87	0 49 5		
SEPT. 6	11 23	+1·54	+1·56	17 12 40	196 51 25	10 W	0·54	G.S.J.	35·70	0 47 48		
„ 13	11 35	+1·49	+1·72	17 14 30	196 51 15	0		V.G.G.	35·94	0 49 26	35·84	0 48 53
„ 20	11 24	+1·46	+1·75	17 13 45	196 51 10	0		G.S.J.	35·81	0 48 42		
„ 27	11 25	+1·49	+1·64	17 14 30	196 51 10	0		V.G.G.	35 93	0 49 36		
OCT. 4	11 29	+1·45	+1·69	17 14 45	196 50 50	0		G.S.J.	36·02	0 50 4		
„ 11	11 27	+1·51	+1·62	17 14 50	196 51 0	0		V.G.G.	36·02	0 50 9	35·99	0 49 59
„ 18	11 25	+1·52	+1·56	17 13 10	196 50 25	0		G.S.J.	35·85	0 49 8		
„ 25	11 27	+1·50	+1·66	17 14 30	196 50 10	0		V.G.G.	36·08	0 50 35		
NOV. 1	11 22	+1·56	+1·49	17 14 20	196 50 10	0		G.S.J.	36·12	0 50 40		
„ 8	11 26	+1·52	+1·61	17 15 0	196 51 35	0		V.G.G.	35·97	0 49 45		
„ 15	11 25	+1·52	+1·60	17 13 50	196 50 50	0		G.S.J.	35·92	0 49 20	36·04	0 50 5
„ 22	11 27	+1·54	+1·59	17 15 0	196 51 10	0		V.G.G.	36·06	0 50 13		
„ 29	11 21	+1·65	+1·36	17 16 30	196 52 50	0		G.S.J.	36·12	0 50 25		
DEC. 6	11 24	+1·52	+1·59	17 17 20	196 53 15	0		V.G.G.	36·14	0 50 27		
„ 13	10 44	+1·44	+1·71	17 16 15	196 53 10	0		G.S.J.	35·93	0 49 13	36·00	0 49 42
„ 20	11 17	+1·57	+1·49	17 16 20	196 53 15	0		V.G.G.	35·97	0 49 37		
„ 27	11 40	+1·52	+1·61	17 16 10	196 52 57	0		C.	35·96	0 49 33		

The Mean Declination for the year 1888 = 0 ° 50 ′ 4 ″

Absolute Magnetical Observations.—Table III.

OBSERVATIONS OF INCLINATION, 1888.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. 2 and $\frac{2}{81}$, by John Dover.

1888. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	12 16	13 59	P.	$\frac{2}{81}$	20 9·9	19 37·4	20 31·4	20 20·2	20 9·7		
,, 6	14 44	16 17	P.	2	20 53·2	20 3·7	19 50·6	19 34·1	20 5·4	No. $\frac{2}{81}$	
,, 10	12 1	13 28	G.S.J.	2	20 54·2	19 34·5	20 30·4	19 24·7	20 5·9	° ′	
,, 14	14 45	16 2	G.S.J.	$\frac{2}{81}$	20 1·0	19 36·6	21 6·5	20 31·1	20 18·8	20 12·5	
,, 17	12 6	13 30	P.	$\frac{2}{81}$	20 0·1	19 42·4	20 37·2	20 24·0	20 10·9		20 9·6
,, 20	14 36	16 6	P.	2	20 42·7	20 2·7	19 50·6	19 40·1	20 4·0	No. 2 ° ′	
,, 24	12 56	14 16	G.S.J.	2	21 9·2	19 45·7	20 15·9	19 25·7	20 9·1	20 6·1	
,, 27	14 29	15 44	G.S.J.	$\frac{2}{81}$	20 0·6	19 31·8	20 50·9	20 23·6	20 11·7		
,, 31	11 55	13 20	P.	$\frac{2}{81}$	20 1·2	19 40·9	20 37·2	20 26·1	20 11·3		
FEB. 3	14 44	16 9	P.	2	20 42·0	19 54·2	20 3·4	19 43·4	20 5·7	No. $\frac{2}{81}$	
,, 7	12 10	13 48	G.S.J.	2	20 31·6	19 30·4	20 26.4	19 44·6	20 3·2	° ′	
,, 11	14 25	15 58	G.S.J.	$\frac{2}{81}$	20 1·6	19 25·6	20 54·0	20 25·6	20 11·7	20 11·4	
,, 14	12 20	14 2	V.G.G.	$\frac{2}{81}$	19 55·7	19 45·1	20 33·9	20 28·7	20 10·8		
,, 17	14 35	16 0	V.G.G.	2	20 30·7	20 7·9	20 7·0	19 57·1	20 10·7	No. 2 ° ′	20 8·3
,, 21	12 0	13 35	G.S.J.	2	20 35·7	19 43·6	20 13·6	19 32·2	20 1·3	20 5·2	
,, 24	14 37	15 59	G.S.J.	$\frac{2}{81}$	19 58·5	19 43·1	20 43·0	20 26.8	20 12·8		
,, 28	12 15	13 36	V.G.G.	$\frac{2}{81}$	19 57·4	19 54·1	20 28·1	20 22·5	20 10·5		
MAR. 2	14 20	15 55	V.G.G.	2	20 20·4	20 14·5	19 53·1	20 2·7	20 7·7	No. $\frac{2}{81}$	
,, 6	12 13	13 45	G.S.J.	2	20 36·0	19 33·4	20 6·4	19 57·4	20 3·3	° ′	
,, 9	14 53	16 21	G.S.J.	$\frac{2}{81}$	20 5·4	19 37·6	20 43·9	20 18·1	20 11·2	20 11·5	
,, 14	12 0	13 40	V.G.G.	$\frac{2}{81}$	19 58·4	19 52·7	20 28·1	20 30·6	20 12·4		
,, 16	14 10	15 32	V.G.G.	2	20 31·9	19 47·4	19 58·9	19 53·0	20 2·8		20 7·6
,, 20	12 9	13 40	G.S.J.	2	20 40·6	19 50·6	20 26.1	19 21·4	20 4·7	No. 2 ° ′	
,, 23	14 44	16 7	G.S.J.	$\frac{2}{81}$	20 12·6	19 28·7	20 25·5	20 35·4	20 10·5	20 4·5	
,, 27	12 5	13 35	V.G.G.	$\frac{2}{81}$	19 58·7	19 52·2	20 31·4	20 25·9	20 12·0		
,, 30	14 35	15 55	V.G.G.	2	20 8·9	20 8·6	19 59·6	19 59·0	20 4·0		
APRIL 3	12 24	13 50	G.S.J.	2	20 35·4	20 9·5	20 12·9	19 45·6	20 10·8		
,, 6	14 35	16 2	G.S.J.	$\frac{2}{81}$	20 11·0	19 52·6	20 27·6	20 25·2	20 14·1	No. $\frac{2}{81}$ ° ′	
,, 10	12 4	13 35	V.G.G.	$\frac{2}{81}$	19 50·1	19 59·1	20 31·6	20 33·9	20 13·7	20 12·3	
,, 13	14 20	15 45	V.G.G.	2	20 24·9	20 11·1	20 6·7	19 52·1	20 8·7		
,, 17	12 20	13 43	G.S J.	2	20 47·5	19 47·5	20 8·0	19 39·9	20 5·7	No. 2 ° ′	20 9·9
,, 21	14 38	16 3	G.S.J.	$\frac{2}{81}$	20 6·9	19 39·4	20 28·5	20 27·5	20 10·6	20 7·4	
,, 24	12 5	13 30	V.G.G.	$\frac{2}{81}$	19 54·4	19 50·2	20 26·4	20 32·7	20 10·9		
,, 27	14 25	15 50	V.G.G.	2	19 47·2	20 18·7	20 3·4	20 9.1	20 4·6		

1888. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 1	12 22	13 47	G.S.J.	2	20 35·4	19 59·4	20 10·7	19 49·7	20 8·8	No. $\frac{2}{81}$ ° ′ 20 12·0	20 10·8
„ 4	14 22	15 58	G.S.J.	$\frac{2}{81}$	20 9·4	19 24·6	20 49·5	20 23·1	20 11·6		
„ 8	12 5	13 39	V.G.G.	$\frac{2}{81}$	20 16·5	19 32·0	20 28·1	20 26·5	20 10·8		
„ 11	14 35	16 6	V.G.G.	2	19 40·9	20 41·6	20 17·6	20 4·5	20 11·1		
„ 15	12 18	13 44	G.S.J.	2	20 42·7	19 32·5	20 5·1	20 11·5	20 7·9		
„ 18	14 45	16 10	G.S.J.	$\frac{2}{81}$	20 16·1	19 40·7	20 26·5	20 20·1	20 10·8	No. 2 ° ′ 20 9·8	
„ 22	12 30	13 55	G.S.J.	$\frac{2}{81}$	20 15·2	19 43·6	20 20·1	20 40·4	20 14·8		
„ 25	14 40	16 8	G.S.J.	2	20 42·2	20 12·9	20 2·7	19 43·7	20 10·4		
„ 29	12 17	13 50	V.G.G.	2	20 25·5	20 4·6	19 44·5	20 29·2	20 10·9		
JUNE 1	15 40	17 0	V.G.G.	$\frac{2}{81}$	19 50·0	20 4·2	20 15·9	20 26·5	20 9·1	No. $\frac{2}{81}$ 20 11·1	20 10·8
„ 5	12 30	13 58	G.S.J.	$\frac{2}{81}$	20 10·0	19 44·4	20 41·7	20 3·6	20 9·9		
„ 8	14 38	16 1	G.S.J.	2	20 41·7	20 15·4	19 55·7	19 57·9	20 12.7		
„ 12	12 5	13 40	V.G.G.	2	20 19·7	20 7·6	20 15·6	20 1·4	20 11·1		
„ 15	15 10	16 30	V.G.G.	$\frac{2}{81}$	19 58·0	20 0·4	20 22·2	20 35·1	20 13·9		
„ 19	12 10	13 40	V.G.G.	$\frac{2}{81}$	20 20·4	20 14·1	19 53·2	20 6·1	20 8·4	No. 2 ° ′ 20 10·5	
„ 22	14 45	16 15	V.G.G.	2	20 17·5	20 18·2	20 8·6	19 58·7	20 10·7		
„ 26	12 25	13 59	G.S.J.	2	20 12·9	20 27·0	20 19·4	19 30·7	20 7·5		
„ 29	14 26	15 58	G.S.J.	$\frac{2}{81}$	20 9·0	19 41·5	20 40·0	20 26·2	20 14·2		
JULY 3	12 18	13 50	V.G.G.	$\frac{2}{81}$	20 14·5	19 24·5	20 41·2	20 22·5	22 10·7	No. $\frac{2}{81}$ ° ′ 20 12·4	20 10·6
„ 6	14 45	16 15	V.G.G.	2	20 7·9	20 23·9	20 17·2	19 55·0	20 11·0		
„ 10	12 8	13 35	G.S.J.	2	20 40·4	20 12·5	19 54·0	19 57·6	20 11·1		
„ 13	14 27	16 2	G.S.J.	$\frac{2}{81}$	20 31·7	20 2·5	20 5·4	20 14·1	20 13·4		
„ 17	12 10	13 35	V.G.G.	$\frac{2}{81}$	20 34·9	20 4·2	20 7·6	20 2·4	20 12·3		
„ 20	14 40	16 6	V.G.G.	2	20 7·4	20 3·4	19 53·2	20 21·1	20 6·3	No. 2 ° ′ 20 8·4	
„ 24	12 15	13 50	G.S.J.	2	20 18·1	20 18·9	20 6·7	19 37·1	20 5·2		
„ 27	14 40	16 10	G.S.J.	$\frac{2}{81}$	20 19·4	20 16·7	19 50·6	20 34·6	20 15·3		
„ 31	12 10	13 40	V.G.G.	$\frac{2}{81}$	20 24·1	20 1·9	20 21·4	19 54·5	20 10·5		
AUG. 3	14 50	16 15	V.G.G.	2	20 11·9	20 1·4	19 57·4	20 22·2	20 8·2	No. $\frac{2}{81}$ ° ′ 20 13·0	20 9·3
„ 7	12 10	13 43	G.S.J.	2	21 34·5	19 11·7	20 4·1	20 0·9	20 12·8		
„ 10	14 30	15 52	G.S.J.	$\frac{2}{81}$	20 30·6	20 39·4	20 9·9	19 30·4	20 12·6		
„ 14	12 20	14 0	V.G.G.	$\frac{2}{81}$	20 35·4	20 26·1	19 43·2	20 12·2	20 14·2		
„ 17	14 50	16 20	V.G.G.	2	20 43·7	18 56·2	20 35·0	20 4·0	20 4·7		
„ 20	12 3	13 38	G.S.J.	2	20 8·2	19 42·5	20 14·4	20 11·1	20 4·0	No. 2 ° ′ 20 6·2	
„ 24	14 40	16 2	G.S.J.	$\frac{2}{81}$	20 23·5	20 1·7	20 20·4	20 7·5	20 13·3		
„ 28	12 20	13 45	V.G.G.	$\frac{2}{81}$	20 30·0	20 1·2	20 21·1	19 56·0	20 12·1		
„ 31	14 55	16 20	V.G.G.	2	20 51·6	19 22·5	20 7·7	19 44·1	20 1·5		

1888. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 4	12 2	13 32	G.S.J.	2	20 27·6	20 8·0	19 27·6	20 5·1	20 2·1	No. $\frac{2}{81}$	
,, 7	14 30	15 53	G.S.J.	$\frac{2}{81}$	20 34·1	20 4·2	20 0·4	20 7·1	20 11·4	° ′	
,, 11	12 18	13 47	V.G.G.	$\frac{2}{81}$	20 31·9	20 6·9	20 10·7	20 5·4	20 13·7	20 14·1	
,, 14	14 45	16 7	V.G.G.	2	20 34·2	19 47·1	20 12·1	19 41·9	20 3·8		20 9·2
,, 18	12 12	13 40	G.S.J.	2	20 21·7	20 9·9	19 51·2	20 2·7	20 6·4	No. 2	
,, 21	14 35	16 0	G.S.J.	$\frac{2}{81}$	20 3·5	20 11·0	20 11·7	20 3·4	20 15·9	° ′	
,, 25	12 10	13 45	V.G.G.	$\frac{2}{81}$	20 40·4	19 49·5	19 58·1	20 3·4	20 15·6	20 4·3	
,, 28	14 55	16 20	V.G.G.	2	20 39·1	19 35·4	20 13·7	19 51·1	20 4·8		
OCT. 2	12 18	13 48	G.S.J.	2	20 27·6	19 55·1	19 44·0	20 22·5	20 7·3	No. $\frac{2}{81}$	
,, 5	14 23	15 52	G.S.J.	$\frac{2}{81}$	19 58·9	19 59·4	20 29·1	20 4·0	20 16·8	° ′	
,, 9	12 10	13 40	V.G.G.	$\frac{2}{81}$	20 43·0	19 49·9	20 32·7	20 8·9	20 18·6	20 18·8	
,, 12	14 35	16 10	V.G.G.	2	20 44·6	19 58·1	20 6·9	19 47·2	20 9·2		
,, 16	12 20	13 48	G.S.J.	2	20 33·7	20 26·2	19 58·5	19 39·0	20 9·3	No. 2	20 13·1
,, 19	14 40	16 5	G.S.J.	$\frac{2}{81}$	20 38·1	20 8·4	19 59·7	20 35·7	20 20·5	° ′	
,, 23	12 15	13 45	V.G.G.	$\frac{2}{81}$	21 4·9	19 22·9	20 30·4	20 18·6	20 19·2	20 8·6	
,, 26	14 45	16 20	V.G.G.	2	20 44·2	20 17·5	19 54·4	19 32·1	20 7·0		
,, 30	12 15	13 41	G.S.J.	2	20 18·9	20 4·2	20 15·2	20 2·1	20 10·1		
NOV. 2	14 25	15 55	G.S.J.	$\frac{2}{81}$	20 21·7	19 40·1	20 38·6	20 35·7	20 19·0	No. $\frac{2}{81}$	
,, 6	12 5	13 30	V.G.G.	$\frac{2}{81}$	20 16·9	20 1·2	20 24·2	20 27·5	20 17·4	° ′	
,, 9	14 49	16 12	V.G.G.	2	20 42·1	19 47·2	20 17·9	19 47·4	20 8·6	20 17·9	
,, 13	12 20	13 43	G.S.J.	2	20 29·1	19 56·1	19 45·9	20 20·0	20 7·8		
,, 16	14 30	15 58	G.S.J.	$\frac{2}{81}$	20 31·2	19 46·1	20 43·4	20 13·0	20 18·4	No 2	20 13·6
,, 20	12 17	13 45	V.G.G.	$\frac{2}{81}$	20 1·4	20 16·4	20 22·0	20 20·1	20 15·0	° ′	
,, 23	14 50	16 20	V.G.G.	$\frac{2}{81}$	20 37·5	19 51·0	19 46·9	20 18·6	20 8·5	20 8 1	
,, 27	12 20	13 48	G.S.J.	2	20 28·4	20 2·6	19 48·0	20 10·9	20 7·5		
,, 30	14 25	15 59	G.S.J.	$\frac{2}{81}$	20 24·9	20 12·5	20 17·9	20 24·3	20 19·9		
DEC. 4	12 5	13 40	V.G.G.	$\frac{2}{81}$	20 32·2	20 12·0	20 8.7	20 29·6	20 20·6	No. $\frac{2}{81}$	
,, 7	14 45	16 10	V.G.G	2	20 39·5	19 34·7	20 31·5	19 55·6	20 10·3	° ′	
,, 11	12 38	14 3	G.S.J.	2	21 22·9	20 32·2	20 20·5	19 40·4	20 29·0	20 10·9	
,, 14	14 45	16 5	G.S.J.	$\frac{2}{81}$	19 44·0	19 51·6	20 22·7	20 26·5	20 6·2	No. 2	20 14·5
,, 18	12 17	13 47	V.G.G.	$\frac{2}{81}$	19 47·7	19 56·2	20 26·1	20 24·4	20 8·6	° ′	
,, 21	14 40	16 20	V.G.G.	2	20 31·7	20 5·0	20 27·7	20 5·7	20 17·5	20 18·0	
,, 25	12 2	13 25	C.	2	20 34·4	20 7·9	20 14·1	20 4·1	20 15·1		
,, 28	14 38	16 3	G.S.J.	$\frac{2}{81}$	19 29·0	20 5·7	20 17·5	20 41·4	20 8·4		

The Mean Dip for the year ... { With Needle No. $\frac{2}{81}$ = 20 13·2 ; With Needle No. 2 = 20 8·1 }

The Mean Dip for the year 1888 = 20 10·6

Absolute Magnetical Observations.—Table III *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1888.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, No. $\frac{1}{81}$ by John Dover and No. 5 by Adie.

1888. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 3	11 10	14 48	P.	5	19 25·6	19 40·7	20 55·1	20 50·4	20 12·9		
„ 6	13 41	17 18	P.	$\frac{1}{81}$	20 14·6	20 3·0	20 15·4	20 18·4	20 12·8	No. 5 20 14·0	
„ 10	11 5	14 32	G.S.J.	$\frac{1}{81}$	20 19·7	19 54·6	20 37·5	20 2·6	20 13·6		
„ 14	13 37	16 55	G.S.J.	5	19 43·2	18 53·4	22 4·6	20 53·2	20 23·6		
„ 17	11 12	14 23	P.	5	19 37·6	19 24·2	21 6·1	20 47·9	20 13·9		20 13·4
„ 20	13 40	16 57	P.	$\frac{1}{81}$	20 11·5	20 2·2	20 16·5	20 18·1	20 12·1	No. $\frac{1}{81}$	
„ 24	12 8	15 18	G.S.J.	$\frac{1}{81}$	20 17·0	20 0·2	20 17·1	20 12·7	20 11·7	20 12·5	
„ 27	13 40	16 45	G.S.J.	5	19 44·1	18 38·0	21 35·6	20 37·4	20 8·8		
„ 31	11 2	14 9	P.	5	19 38·0	19 8·0	21 23·4	20 33·9	20 10·8		
FEB. 3	13 51	16 58	P.	$\frac{1}{81}$	20 7·1	19 59·4	20 22·6	20 18·5	20 11·9		
„ 7	11 15	14 42	G.S.J.	$\frac{1}{81}$	20 15·9	19 51·5	20 23·0	20 10·7	20 10·3	No. 5 20 6·1	
„ 11	13 35	16 58	G.S.J.	5	19 23·7	18 18·5	21 53·0	20 41·5	20 4·2		
„ 14	11 26	14 52	V.G.G.	5	19 29·9	18 34·7	21 47·0	20 30·6	20 5·5		20 9·0
„ 17	13 42	16 55	V.G.G.	$\frac{1}{81}$	20 8·1	20 5·1	20 21·1	20 15·7	20 12·5		
„ 21	11 8	14 30	G.S.J.	$\frac{1}{81}$	20 16·5	19 56·5	20 32·5	20 4·9	20 12·6	No. $\frac{1}{81}$	
„ 24	13 40	16 59	G.S.J.	5	19 38·1	18 49·6	21 17·7	20 46·2	20 7·9	20 11·8	
„ 28	11 25	14 40	V.G.G.	5	19 35·5	19 4·5	21 1·2	20 46·9	20 7·0		
MAR. 2	13 20	16 45	V.G.G.	$\frac{1}{81}$	20 10·5	20 1·6	20 17·0	20 9·6	20 9·7		
„ 6	11 20	14 41	G.S.J.	$\frac{1}{81}$	20 19·0	19 55·1	20 22·6	20 13·1	20 12·4	No. 5 20 13·2	
„ 9	13 50	17 8	G.S.J.	5	19 38·9	18 58·5	21 47·4	20 48·2	20 18·2		
„ 14	11 12	14 40	V.G.G.	5	19 28·1	19 8·2	21 9·5	20 49·6	20 8·8		
„ 16	13 30	16 30	V.G.G.	$\frac{1}{81}$	20 12·1	20 2·6	20 27·6	20 16·5	20 14·7		20 13·0
„ 20	11 20	14 33	G.S.J.	$\frac{1}{81}$	20 15·7	19 58·6	20 27·2	20 13·1	20 13·6	No. $\frac{1}{81}$	
„ 23	13 55	17 2	G.S.J.	5	19 38·4	19 3·0	21 33·4	20 53·7	20 17·1	20 12·8	
„ 27	11 15	14 30	V.G.G.	5	19 31·6	18 55·4	21 6·5	21 0·9	20 8·6		
„ 30	13 50	16 35	V.G.G.	$\frac{1}{81}$	20 7·5	20 8·6	20 23·7	20 14·4	20 13·5		
APRIL 3	11 35	14 37	G.S.J.	$\frac{1}{81}$	20 13·6	20 2·2	20 23·9	20 13·5	20 13·3		
„ 6	13 40	17 14	G.S.J.	5	19 34·4	18 45·6	21 51·5	20 55·2	20 16·7	No. 5 20 10·2	
„ 10	11 15	14 30	V.G.G.	5	19 27·5	18 51·9	21 20·7	21 6·2	20 11·6		
„ 13	13 35	16 28	V.G.G.	$\frac{1}{81}$	20 14·1	20 9·2	20 23·9	20 3·0	20 12·5		20 11·7
„ 17	11 22	14 37	G.S.J.	$\frac{1}{81}$	20 14·1	19 55·7	20 25·1	20 16·5	20 12·8		
„ 21	13 37	16 58	G.S.J.	5	19 8·1	17 0·9	22 16·6	21 50·4	20 4·0	No. $\frac{1}{81}$	
„ 24	11 20	14 30	V.G.G.	5	19 31·6	18 32·2	21 22·1	21 9·1	20 8·7	20 13·1	
„ 27	13 30	16 38	V.G.G.	$\frac{1}{81}$	20 17·9	20 14·0	20 12·5	20 11·2	20 13·9		

1888. Date.	Bombay Civil Time (0 to 24 hours). At commencement. h. m.	At conclusion. h. m.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East. ° ′	A. Face of Circle. West. ° ′	B. Face of Circle. East. ° ′	B. Face of Circle. West. ° ′	Mean Dip. ° ′	Monthly Mean for each Needle.	Monthly Mean. ° ′
MAY 1	11 17	14 40	G.S.J.	1/81	20 16·5	20 9·1	20 20·4	20 9·7	20 11·7		
„ 4	13 30	16 52	G.S.J.	5	19 29·9	18 44·6	21 21·5	21 16·6	20 13·1	No. 5	
„ 8	11 15	14 40	V.G.G.	5	19 37·7	18 42·0	21 41·0	20 40·9	20 10·4	20 9·2	
„ 11	13 40	16 45	V.G.G.	1/81	20 17·0	20 0·1	20 7·6	20 31·1	20 13·9		
„ 15	11 22	14 38	G.S.J.	1/81	20 17·0	20 6·7	20 13·2	20 17·5	20 13·6		20 11·8
„ 18	13 50	17 8	G.S.J.	5	19 15·5	18 30·6	21 29·5	21 5·2	20 5·2	No. 1/81	
„ 22	11 30	14 50	G.S.J.	5	19 15·2	18 26·6	21 42·9	21 7·9	20 8·1	20 13·9	
„ 25	13 40	16 54	G.S.J.	1/81	20 5·6	20 16·4	20 22·1	20 17·7	20 15·4		
„ 29	11 26	14 45	V.G.G.	1/81	20 7·6	20 17·1	20 15·7	20 18·5	20 14·7		
JUNE 1	15 0	17 55	V.G.G.	5	19 4·1	19 3·0	21 34·1	21 4·6	20 11·4		
„ 5	11 30	14 55	G.S.J.	5	19 21·7	19 3·7	21 33·4	20 54·7	20 13·4	No. 5	
„ 8	13 40	16 52	G.S.J.	1/81	20 12·4	20 2·5	20 17·5	20 15·7	20 12·0	20 11·8	
„ 12	11 20	14 35	V.G.G.	1/81	20 7·2	20 6·7	20 6·0	20 16·6	20 9·1		
„ 15	14 30	17 17	V.G.G.	5	19 32·6	19 9·2	21 21·4	20 51·7	20 13·7		20 11·8
„ 19	11 20	14 40	V.G.G.	5	19 30·5	18 41·5	21 21·7	21 15·7	20 12·3	No. 1/81	
„ 22	13 50	16 58	V.G.G.	1/81	20 5·4	20 15·5	20 8·6	20 12·9	20 10·6	20 11·7	
„ 26	11 28	14 57	G.S.J.	1/81	20 9·6	19 59·7	20 31·5	20 19·5	20 15·1		
„ 29	13 36	16 53	G.S.J.	5	19 40·0	19 1·1	21 16·1	20 35·9	20 8·3		
JULY 3	11 30	14 40	V.G.G.	5	19 35·6	18 47·7	21 35·4	20 31·9	20 7·6		
„ 6	13 50	16 59	V.G.G.	1/81	20 1·9	20 5·6	20 18·1	20 24·0	20 12·4	No. 5	
„ 10	11 15	14 33	G.S.J.	1/81	20 5·2	20 12·2	20 23·6	20 19·5	20 15·1	20 8·6	
„ 13	13 35	16 54	G.S.J.	5	19 24·5	18 19·9	21 48·0	21 2·1	20 8·6		
„ 17	11 23	14 32	V.G.G.	5	19 21·2	18 35·0	21 46·6	20 49·7	20 8·1		20 10·8
„ 20	13 45	16 55	V.G.G.	1/81	20 10·0	20 6·7	20 16·5	20 16·0	20 12·3	No. 1/81	
„ 24	11 18	14 40	G.S.J.	1/81	20 21·2	20 9·6	20 19·2	20 7·1	20 14·3	20 13·5	
„ 27	13 42	16 59	G.S.J.	5	19 26·1	18 57·0	21 9·7	21 3·0	20 8·9		
„ 31	11 20	14 40	V.G.G.	5	19 16·5	19 14·1	21 2·5	21 5·4	20 9·6		
AUG. 3	13 50	16 55	V.G.G.	1/81	20 16·9	20 5·9	20 28·0	20 12·0	20 15·7		
„ 7	11 20	14 42	G.S.J.	1/81	19 49·7	20 14·7	20 5·0	20 21·7	20 7·8	No. 5	
„ 10	13 35	16 42	G.S.J.	5	19 23·0	18 48·5	21 19·0	20 58·4	20 7·2	20 8·2	
„ 14	11 25	14 45	V.G.G.	5	19 18·2	18 58·7	21 14·7	20 49·9	20 5·4		
„ 17	13 50	17 5	V.G.G.	1/81	20 12·7	20 3·6	20 4·4	20 15·7	20 9·1		20 9·3
„ 20	11 12	14 32	G.S.J.	1/81	20 5·1	20 9·6	20 29·2	19 53·1	20 9·2	No. 1/81	
„ 24	13 45	17 3	G.S.J.	5	19 12·1	19 16·0	20 58·4	21 9·5	20 9·0	20 10·1	
„ 28	11 25	14 40	V.G.G.	5	19 12·6	18 57·1	21 25·4	21 9·7	20 11·2		
„ 31	14 10	17 15	V.G.G.	1/81	20 8·5	19 36·4	20 41·4	20 8·6	20 8·7		

1888. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 4	11 10	14 33	G.S.J.	1/81	20 10·4	19 45·2	20 29·7	20 25·1	20 12·6		
„ 7	13 33	16 51	G.S.J.	5	19 19·2	18 22·0	20 53·4	21 48·4	20 5·7	No. 5	
„ 11	11 28	14 45	V.G.G.	5	19 21·4	18 15·7	21 19·2	21 29·5	20 6·4	° ′ 20 5·2	
„ 14	13 55	17 2	V.G.G.	1/81	20 19·4	19 51·0	20 12·9	20 14·2	20 9·4		20 8·5
„ 18	11 20	14 39	G.S.J.	1/81	20 20·0	20 5·9	20 11·9	20 10·5	20 12·1	No. 1/81	
„ 21	13 40	16 52	G.S.J.	5	18 54·0	18 8·0	21 16·2	21 56·5	20 3·7	° ′	
„ 25	11 20	14 30	V.G.G.	5	18 48·6	18 7·6	21 29·7	21 54·0	20 5·0	20 11·9	
„ 28	14 7	17 15	V.G.G.	1/81	20 17·5	20 6·5	20 25·5	20 4·2	20 13·4		
OCT. 2	11 25	14 40	G.S.J.	1/81	20 24·4	20 3·0	20 8·5	20 11·7	20 11·9		
„ 5	13 33	16 50	G.S.J.	5	18 51·9	18 14·0	21 13·9	21 52·0	20 2·9	No. 5	
„ 9	11 20	14 35	V.G.G.	5	18 38·5	18 20·7	21 59·2	21 17·4	20 3·9	° ′ 20 2·7	
„ 12	13 50	17 3	V.G.G.	1/81	20 11·6	19 58·6	20 31·0	20 5·6	20 11·7		
„ 16	11 25	14 40	G.S.J.	1/81	20 20·0	19 53·7	20 36·0	20 0·9	20 12·6		20 8·3
„ 19	13 40	16 53	G.S.J.	5	18 49·9	19 5·9	21 5·1	21 7·2	20 2·0	No. 1/81	
„ 23	11 20	14 39	V.G.G.	5	18 41·4	18 56·7	21 40·5	20 49·6	20 2·0	° ′ 20 12·8	
„ 26	13 50	17 7	V.G.G.	1/81	20 5·1	20 8·2	20 16·5	20 23·5	20 13·3		
„ 30	11 20	14 33	G.S.J.	1/81	20 4·2	20 24·4	20 14·0	20 14·5	20 14·3		
NOV. 2	13 34	16 50	G.S.J.	5	18 29·4	18 57·0	21 3·7	21 33·0	20 0·8		
„ 6	11 15	14 30	V.G.G.	5	19 14·5	20 53·1	21 4·4	21 8·0	20 5·0	No. 5	
„ 9	13 56	17 1	V.G.G.	1/81	19 56·0	20 2·6	20 37·2	20 3·9	20 9·9	° ′ 20 5·0	
„ 13	11 20	14 36	G.S.J.	1/81	19 59·7	20 15·9	20 16·6	20 9·5	20 10·4		
„ 16	13 37	16 53	G.S.J.	5	19 7·7	19 7·6	21 6·6	21 4·5	20 6·6		20 7·5
„ 20	11 25	14 35	V.G.G.	5	19 16·6	18 59·2	20 43·1	21 35·6	20 8·6	No. 1/81	
„ 23	13 50	17 10	V.G.G.	1/81	20 6·2	20 2·7	20 7·0	20 31·6	20 11·9	° ′ 20 10·6	
„ 27	11 20	14 37	G.S.J.	1/81	20 5·0	20 4·5	20 25·1	20 6.9	20 10·4		
„ 30	13 35	16 52	G.S.J.	5	18 53·2	19 2·7	21 20·9	20 59.6	20 4·1		
DEC. 4	11 15	14 39	V.G.G.	5	19 23·7	19 11·9	21 9·2	20 58.1	20 10·7		
„ 7	13 50	17 0	V.G.G.	1/81	20 18·0	20 8·0	20 7·6	20 17.9	20 12·9	No. 5	
„ 11	11 47	14 56	G.S.J.	1/81	20 33·4	20 10·6	20 9·2	20 16.6	20 17·4	° ′ 20 20·4	
„ 14	13 55	16 58	G.S.J.	5	19 24·8	18 48·3	21 53·6	20 53·3	20 15·0		
„ 18	11 25	14 40	V.G.G.	5	19 36·7	20 10·4	20 42·2	21 8.6	20 24·5		20 18·6
„ 21	13 50	17 5	V.G.G.	1/81	20 33·2	20 8·2	20 29·0	20 0.9	20 17·8	No. 1/81	
„ 25	11 12	14 22	C.	1/81	20 28·1	20 10·2	20 25·4	20 12.2	20 18·9	° ′ 20 16·7	
„ 28	13 48	16 59	G.S.J.	5	19 28·2	20 58·5	20 46·6	20 53.0	20 31·6		

The Mean Dip for the year... { with Needle No. 5 = ° ′ 20 9·5 ; with Needle No. 1/81 = 20 12·6 }

The Mean Dip for the year 1888 = ° ′ 20 11·1

Absolute Magnetical Observations.—Table IV.

Observations of Vibration and Deflection, taken with the Kew Unifilar Magnetometer (No. 23, by Elliott Brothers), for the determination of Absolute Horizontal Force.

1889.

1889. Date.	Civil Time. Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Temperature.	Rate of Chronometer.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Temperature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermometer.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8} - X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8} + X_{1\cdot0}}{2}$	Monthly Mean Values of X.	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
JAN. 2	12 16	2·8312	0·68	86·1	+11·1	15·71	80 9	17 36 42	8 57 0	86·5	15·52	81·4	G.S.J.	·64204	8·1154	8·1147	+·0007	8·1150		
,, ,,	15 21	2·8318	0·68	86·9	+11·1	15·24	83·1	17 36 23	8 56 47	88·7	15·44	82·3	G.S.J.	·64208	8·1137	8·1132	+·0005	8·1134		
,, 9	12 8	2·8308	0·61	88·5	+10·6	15·99	83·0	17 35 2	8 56 7	88·9	15·81	83·7	G.S.J.	·64198	8·1229	8·1223	+·0006	8·1226		
,, ,,	15 13	2·8314	0·51	87·3	+10·6	15·40	85·1	17 35 22	8 56 15	89·2	15·58	84·6	G.S.J.	·64196	8·1186	8·1184	+·0002	8·1185		
,, 16	12 5	2·8306	0·61	82·0	+12·0	16·59	77 7	17 37 35	8 57 17	82·0	16·45	78·1	V.G.G.	·64180	8·1147	8·1150	−·0003	8·1148		
,, ,,	15 17	2·8311	0·64	81·5	+12·0	16·15	79·8	17 37 10	8 57 2	83·8	16·25	79·0	V.G.G.	·64167	8·1126	8·1132	−·0006	8·1129	8·1179	3·7430
,, 23	12 8	2·8300	0·53	85·4	+10·6	16 18	81·7	17 36 20	8 56 42	84·6	16·03	82·0	G.S.J.	·64199	8·1216	8·1216	·0000	8·1216		
,, ,,	15 16	2·8297	0·59	81·3	+10·6	15·67	81·9	17 36 58	8 57 1	83·5	15·74	81·9	G.S.J.	·64196	8·1176	8·1175	+·0001	8·1175		
,, 30	12 13	2·8300	0·54	86·0	+10·4	16·07	81·0	17 35 55	8 56 30	86·0	15·93	81·6	V.G.G.	·64204	8·1221	8·1221	·0000	8·1221		
,, ,,	15 16	2·8304	0·55	86·0	+10·4	15·59	82·8	17 35 42	8 56 25	86·9	15·82	82·2	V.G.G.	·64205	8·1210	8·1208	+·0002	8·1209		
FEB. 6	12 15	2·8285	0·59	82·9	+10·5	16·89	77·9	17 36 0	8 56 36	82·7	16·78	78·8	G.S.J.	·64198	8·1264	8·1261	+·0003	8·1262		
,, ,,	15 24	2·8293	0 50	81·7	+10·5	16·06	81 3	17 36 34	8 56 51	82·9	16·34	80·4	G.S.J.	·64196	8·1212	8·1208	+·0004	8·1210		
,, 13	12 15	2·8292	0·65	84·0	+11·1	16·80	80·0	17 35 10	8 56 12	84·9	16·69	80·4	V.G.G.	·64180	8·1266	8·1261	+·0005	8·1263		
,, ,,	15 12	2·8304	0·64	84·4	+11·1	16·03	82·4	17 35 30	8 56 20	86·1	16·33	81·5	V.G.G.	·64183	8·1210	8·1206	+·0004	8·1208		
,, 20	12 17	2·8298	0·73	83·6	+11·7	16·46	79·0	17 36 15	8 56 40	85·0	16·28	79·6	G.S.J.	·64190	8·1203	8·1201	+·0002	8·1202	8·1204	3·7442
,, ,,	15 23	2·8314	0·71	84 0	+11·7	15 55	82·0	17 36 43	8 56 52	86·2	15·69	81·2	G.S.J.	·64184	8·1133	8·1135	−·0002	8·1134		
,, 27	12 12	2·8301	0·64	84·3	+11·0	16·51	80·5	17 36 15	8 56 40	84·8	16 25	80·9	V.G.G.	·64183	8·1203	8·1203	·0000	8·1203		
,, ,,	15 16	2·8314	0·69	83·7	+11·0	15·73	81·6	17 36 27	8 56 45	85·4	15·97	81·3	V.G.G.	·64177	8·1147	8·1148	−·0001	8·1147		
MARCH 6	12 23	2·8311	0·85	93·0	+9·7	16·01	83·8	17 34 10	5 55 41	91·6	15·70	84·5	G.S.J.	·64204	8·1259	8·1253	+·0006	8·1256		
,, ,,	15 8	2·8339	0·77	90·8	+9·7	14·31	87·0	17 34 23	8 55 49	92·7	15·23	85·8	G.S.J.	·64189	8·1145	8·1137	+·0008	8·1141		
,, 13	12 13	2·8328	0·68	88·0	+8·8	15·72	84·2	17 35 12	8 56 17	88·4	15·45	84·7	V.G.G.	·64143	8·1160	8·1148	+·0012	8·1154		
,, ,,	15 25	2·8335	0·69	88·0	+8·8	14·79	85·5	17 35 30	8 56 27	89·3	14·94	85·2	V.G.G.	·64158	8·1122	8·1109	+·0013	8·1115		
,, 20	12 15	2·8302	0·59	86·4	+10·4	15·99	82·8	17 35 35	8 56 26	86·3	15·72	83·3	G.S.J.	·64187	8·1229	8·1219	+·0010	8·1224	8·1181	3·7431
,, ,,	15 17	2·8315	0·56	85·7	+10·4	15·29	83·9	17 35 49	8 56 31	86·6	15·46	83·9	G.S.J.	·64180	8·1173	8·1169	+·0004	8·1171		
,, *27	12 14	2·8302	0·53	86·0	+10·3	15·54	83·7	17 35 40	8 56 27	86·7	15·50	83·8	V.G.G.	·64199	8·1219	8·1214	+·0005	8·1216		
,, ,,	15 15	2·8310	0·53	85·7	+10·3	15·12	84 2	17 36 0	8 56 35	87·9	15·21	84·0	V.G.G.	·64202	8·1171	8·1167	+·0004	8·1169		

* Large gun standing on road outside boundary wall of Observatory at the time of this observation.

1889. Date.	Civil Time, Mean.	Magnet N. 23 *a*. Time of one Vibration.	Effect of 90° Torsion.	Tempe-rature.	Rate of Chrono-meter.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermo-meter.	Angle of Deflection of Magnet N. 23 *c* by N. 23 *a* at Distance. 0·8 foot.	1·0 foot.	Tempe-rature.	Corresponding Mean Reading of L. H. F. Magnetometer. Scale Reading.	Thermo-meter.	Observer.	Calculated Results in English Units. Values of m.	Values of X. From Deflections at distance. 0·8 foot ($X_{0\cdot8}$)	1·0 foot ($X_{1\cdot0}$)	Difference. $X_{0\cdot8}-X_{1\cdot0}$	Mean. $\frac{X_{0\cdot8}+X_{1\cdot0}}{2}$	Monthly Mean Values of X,	Monthly Mean Values of X in Metrical Units.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	h. m.	s.	Sc. div.	°	s.		°	° ′ ″	° ′ ″	°		°								
April 3	12 14	2·8295	0·45	87·0	+9·6	16·28	83·3	17 34 54	8 56 4	87·0	15·89	83·6	G.S.J.	·64187	8·1276	8·1270	+·0006	8·1273		
„ „	15 24	2·8317	0·44	87·4	+9·6	15·35	84·7	17 35 16	8 56 15	88·0	15·43	84·3	G.S.J.	·64176	8·1193	8·1188	+·0005	8·1190		
„ 10	12 7	2·8313	0·44	87·7	+9·8	15·70	83·0	17 35 40	8 56 30	87·6	15·52	83·0	V.G.G.	·64187	8·1195	8·1186	+·0009	8·1190		
„ „	15 16	2·8319	0·40	85·9	+9·8	15·13	84·2	17 35 47	8 56 35	88·5	15·31	83·9	V.G.G.	·64187	8·1152	8·1139	+·0013	8·1145		
„ 17	12 16	2·8306	0·48	90·7	+9·0	15·87	86·2	17 33 34	8 55 25	90·4	15·56	86·5	G.S.J.	·64176	8·1292	8·1287	+·0005	8·1289	8·1212	3·7445
„ „	15 20	2·8326	0·50	89·9	+9·0	14·90	87·2	17 34 2	8 55 37	91·0	15·12	87·0	G.S.J.	·64164	8·1204	8·1201	+·0003	8·1202		
„ 24	11 59	2·8316	0·50	90·1	+9·1	15·48	86·1	17 34 7	8 55 40	90·4	15·36	86·6	V.G.G.	·64176	8·1238	8·1234	+·0004	8·1236		
„ „	15 18	2·8325	0·51	87·0	+9·1	14·72	87·3	17 34 27	8 55 50	90·0	14·99	87·2	V.G.G.	·64156	8·1178	8·1173	+·0005	8·1175		
May 1	12 16	2·8327	0·48	92·5	+9·4	15·07	87·5	17 33 47	8 55 31	92·3	14·84	87·9	G.S.J.	·64167	8·1225	8·1218	+·0007	8·1221		
„ „	15 27	2·8336	0·49	92·0	+9·4	14·40	89·0	17 34 0	8 55 36	93·6	14·51	88·5	G.S.J.	·64167	8·1173	8·1169	+·0004	8·1171		
„ 8	12 9	2·8335	0·45	92·9	+8·4	14·63	88·7	17 33 35	8 55 23	93·8	14·59	89·0	V.G.G.	·64162	8·1197	8·1193	+·0004	8·1195		
„ „	15 17	2·8338	0·49	92·0	+8·4	14·17	90·1	17 33 30	8 55 20	95·1	14·36	89·9	V·G·G.	·64164	8·1171	8·1169	+·0002	8·1170		
„ 15	11 59	2·8333	0·49	92·9	+8·9	14·92	88·3	17 33 8	8 55 10	93·5	14·79	88·7	G.S.J.	·64149	8·1221	8·1218	+·0003	8·1219		
„ „	15 11	2·8339	0·48	92·8	+8·9	14·36	89·8	17 33 32	8 55 19	94·6	14·49	89·3	G.S.J.	·64159	8·1180	8·1180	·0000	8·1180	8·1183	3·7432
„ 22	12 11	2·8334	0·49	93·0	+8·5	14·45	90·1	17 33 55	8 55 32	94·9	14·26	90·3	V.G.G.	·64174	8·1176	8·1175	+·0001	8·1175		
„ „	15 15	2·8346	0·54	93·0	+8·5	13·34	91·2	17 34 5	8 55 37	95·5	13·77	91·1	V.G.G.	·64184	8·1132	8·1128	+·0004	8·1130		
„ 29	12 7	2·8337	0·46	94·3	+8·2	14·74	89·2	17 33 1	8 55 3	94·9	14·52	89·7	G.S.J.	·64150	8·1214	8·1214	·0000	8·1214		
„ „	15 12	2·8350	0·48	93·0	+8·2	13·95	90·5	17 33 18	8 55 12	95·3	14·19	90·1	G.S.J.	·64140	8·1152	8·1150	+·0002	8·1151		
June 5	12 19	2·8333	0·55	91·5	+9·5	15·02	89·0	17 33 52	8 55 27	90·9	14·76	89·1	V.G.G.	·64131	8·1206	8·1208	−·0002	8·1207		
„ „	15 6	2·8340	0·52	87·7	+9·5	14·36	89·0	17 34 22	8 55 42	90·7	14·59	89·0	V.G.G.	·64125	8·1137	8·1139	−·0002	8·1138		
„ 12	12 17	2·8314	0·40	88·9	+8·8	15·52	85·7	17 33 41	8 55 25	89·9	15·33	86·1	G.S.J.	·64150	8·1257	8·1255	+·0002	8·1256		
„ „	15 23	2·8331	0·46	90·3	+8·8	14·71	87·0	17 33 57	8 55 32	90·9	14·97	86·8	GS.J.	·64153	8·1199	8·1199	·0000	8·1199	8·1208	3·7443
„ 19	12 14	2·8320	0·46	88·1	+8·6	15·42	86·0	17 34 5	8 55 35	88·6	15·31	86·0	V.G.G.	·64134	8·1229	8·1229	·0000	8·1229		
„ „	15 15	2·8331	0·44	87·9	+8·6	14·85	86·0	17 34 22	8 55 42	88·6	15·11	85·9	V.G.G.	·64133	8·1184	8·1186	−·0002	8·1185		
„ 26	12 20	2·8295	0·42	82·9	+8·4	15·91	82·5	17 35 25	8 56 17	83·4	15·78	82·4	G.S.J.	·64155	8·1253	8·1249	+·0004	8·1251		
„ „	15 22	2·8308	0·46	82·0	+8·4	15·37	82·1	17 35 41	8 56 24	82·9	15·58	82·2	G.S.J.	·64142	8·1203	8·1201	+·0002	8·1202		
July 3	12 7	2·8314	0·45	89·7	+7·5	15·31	85·0	17 34 0	8 55 35	88·5	15·34	85·0	V.G.G.	·64162	8·1262	8·1261	+·0001	8·1261		
„ „	15 16	2·8326	0·43	88·7	+7·5	14·71	85·8	17 33 45	8 55 27	90·3	15·06	85·6	V.G.G.	·64148	8·1212	8·1208	+·0004	8·1210		
„ 10	12 17	2·8315	0·44	86·0	+8·2	15·54	82·8	17 34 58	8 56 7	85·7	15·40	83·1	G.S.J.	·64139	8·1218	8·1210	+·0008	8·1214		
„ „	15 23	2·8318	0·41	84·9	+8·2	15·08	83·5	17 35 4	8 56 11	85·8	15·21	83·4	G.S.J.	·64140	8·1195	8·1188	+·0007	8·1191		
„ 17	12 12	2·8291	0·43	82·3	+8·4	17·05	82·3	17 34 37	8 56 5	82·6	15·40	82·3	V.G.G.	*						
„ „	15 16	2·8351	0·42	82·0	+8·4	13·97	82·7	17 35 52	8 56 47	83·2	14·74	82·5	V.G.G.	*					8·1204	3·7442
„ 24	12 17	2·8321	0·44	86·8	+8·8	15·16	84·0	17 34 26	8 55 58	87·0	15·04	84·4	G.S.J.	·64130	8·1216	8·1201	+·0015	8·1208		
„ „	15 24	2·8329	0·42	86·7	+8·8	14·61	84·8	17 34 51	8 56 9	87·3	14·82	84·7	G.S.J.	·64139	8·1175	8·1160	+·0015	8·1167		
„ 31	11 59	2·8321	0·43	88·1	+9·5	14·82	85·0	17 34 7	8 55 42	88·8	14·70	85·3	V.G.G.	·64140	8·1223	8·1216	+·0007	8·1219		
„ „	15 13	2·8331	0·45	88·0	+9·5	14·48	85·9	17 34 30	8 55 55	89·9	14·45	85·9	V.G.G.	·64139	8·1171	8·1161	+·0010	8·1166		

AUGUST	7	12 11	2·8304	0·44	84·5	+9·7	15 72	82·8	17 34 25	8 55 55	84·8	15·55	83·1	G.S.J.	·64133	8·1266	8·1253	+·0013	8·1259				
	,, ,,	15 18	2 8317	0 43	83·6	+9·7	14·99	83·5	17 35 22	8 56 19	84·5	15·19	83·5	G.S.J.	·64137	8·1190	8·1182	+·0008	8·1186				
	,, 14	12 13	2·8312	0·46	85·9	+8·6	15·46	82·9	17 34 7	8 55 37	86·5	15·34	83·3	V.G.G.	·64125	8·1249	8·1249	·0000	8·1249				
	,, ,,	15 10	2·8325	0·50	84·3	+8·6	14·74	83·6	17 35 2	8 56 2	85·6	14·97	83·7	V.G.G.	·64118	8·1173	8·1173	·0000	8·1173		8·1204		3·7442
	,, 21	12 12	2·8318	0·46	85·9	+8·4	15·30	83·8	17 34 46	8 55 56	85·3	15·10	83·8	G.S.J.	·64115	8·1219	8·1218	+·0001	8·1218				
	,, ,,	15 21	2·8329	0·46	85·0	+8·4	14·63	84·0	17 35 12	8 56 12	85·5	14·88	83·8	G.S.J.	·64121	8·1161	8·1158	+·0003	8·1159				
*	,, 28	12 21	2·8328	0·48	87·6	+8·8	14·82	83·9	17 34 15	8 55 45	87·3	14·84	84·3	V.G.G.	·64118	8·1204	8·1199	+·0005	8·1201				
	,, ,,	15 19	2·8328	0·47	85·4	+8·8	14·68	84·4	17 34 2	8 55 41	87·7	14·76	84·5	V.G.G.	·64102	8·1191	8·1180	+·0011	8·1185				
SEPTEMBER	4	12 15	2·8326	0·49	87·4	+9·8	15·15	83·8	17 33 51	8 55 37	87·3	15·19	83·9	G.S.J.	·64112	8·1225	8·1214	+·0011	8·1219				
	,, ,,	15 14	2·8327	0·50	87·0	+9·8	14·92	84·6	17 34 c	8 55 4c	87·9	15·05	84·3	G.S.J.	·64117	8·1208	8·1199	+·0009	8·1203				
	,, 11	12 2	2·8335	0·49	86·9	+9·4	14·23	84·6	17 35 35	8 56 27	87·1	14·17	84·9	V.G.G.	·64134	8·1133	8·1124	+·0009	8·1128				
	,, ,,	15 16	2·8330	0·46	86·0	+9·4	14·23	85·5	17 35 37	8 56 28	88·1	13·97	85·4	V.G.G.	·64134	8·1130	8·1120	+·0010	8·1125		8·1179		3·7430
	,, 18	12 8	2·8323	0·55	87·6	+9·0	14·90	84·5	17 33 57	8 55 31	88·1	14·74	84·9	G.S.J.	·64115	8·1223	8·1223	·0000	8·1223				
	,, ,,	15 26	2·8330	0·60	87·3	+9·0	14·62	85·7	17 33 53	8 55 26	88·6	14·71	85·4	G.S.J.	·64103	8·1199	8·1203	−·0004	8·1201				
	,, 25	12 15	2·8333	0·58	88·1	+9·1	14·51	85·9	17 34 2	8 55 32	88·8	14·56	86·3	V.G.G.	·64112	8·1190	8·1191	−·0001	8·1190				
	,, ,,	15 15	2·8338	0·58	86·9	+9·1	14·10	86·9	17 34 4c	8 55 47	89·0	14·28	86·8	V.G.G.	·64114	8·1139	8·1145	−·0006	8·1142				
OCTOBER	2	12 4	2·8311	0·66	86·0	+9·8	15·68	83·1	17 33 46	8 55 25	86·0	15·42	83·6	G.S.J.	·64105	8·1268	8·1268	·0000	8·1268				
	,, ,,	15 18	2·8325	0·70	86·6	+9·8	14·91	84·6	17 34 16	8 55 42	86·9	15·11	84·2	G.S.J.	·64117	8·1206	8·1204	+·0002	8·1205				
	,, 9	12 9	2·8319	0·65	88·0	+9·1	15·05	85·0	17 33 37	8 55 27	88·3	14·88	85·3	V.G.G.	·64119	8·1247	8·1240	+·0007	8·1243				
	,, ,,	15 19	2·8330	0 67	87·9	+9·1	14·30	85·9	17 33 57	8 55 35	88·7	14·42	85·8	V.G.G.	·64115	8·1199	8·1193	+·0006	8·1196				
	,, 16	12 17	2·8327	0·72	90·9	+9·9	14·82	86·7	17 33 17	8 55 19	90·7	14·76	87·1	G.S.J.	·64136	8·1238	8·1229	+·0009	8·1233		8·1210		3·7444
	,, ,,	15 27	2·8335	0·77	89·9	+9·9	14·37	87·8	17 33 38	8 55 31	90·9	14·50	87·6	G.S.J.	·64127	8·1193	8·1180	+·0013	8·1186				
	,, 22	12 14	2·8317	0·75	85·0	+10·9	15·19	82·6	17 34 55	8 56 8	86·1	14·92	83·1	V.G.G.	·64124	8·1199	8·1188	+·0011	8·1193				
	,, ,,	15 19	2·8330	0·79	86·9	+10·9	14·35	84·1	17 35 25	8 56 22	86·4	14·53	83·9	V.G.G.	·64139	8·1154	8·1147	+·0007	8·1150				
	,, 30	12 9	2·8309	0·93	85·4	+11·1	15·80	81·5	17 34 11	8 55 48	85·6	15·57	82·0	G.S.J.	·64121	8·1255	8·1242	+·0013	8·1248				
	,, ,,	15 22	2·8322	0·95	85·1	+11·1	15·07	84·1	17 34 38	8 56 4	86·3	15·19	83·4	G.S.J.	·64115	8·1191	8·1176	+·0015	8·1183				
NOVEMBER	6	12 10	2·8313	1·00	86·1	+11·3	15·65	82·9	17 33 42	8 55 35	86·6	15·33	83·4	V.G.G.	·64103	8·1255	8·1242	+·0013	8·1248				
	,, ,,	15 20	2·8331	1·00	86·1	+11·3	14·68	84·9	17 34 20	8 55 52	87·9	14·97	84·1	V.G.G.	·64111	8·1169	8·1158	+·0011	8·1163				
	,, 13	12 18	2·8302	1·08	82·8	+12·8	16·22	79·1	17 34 30	8 55 59	83·1	15·95	79·6	G.S.J.	·64106	8·1262	8·1247	+·0015	8·1254				
	,, ,,	15 26	2·8311	1·12	82·0	+12·8	15·47	81·7	17 34 52	8 56 7	84·6	15·63	80·7	G.S.J	·64109	8·1201	8·1190	+·0011	8·1195		8·1194		3·7437
	,, 20	12 11	2·8308	1·15	83·0	+11·8	16·20	79·8	17 34 32	8 56 0	83·0	16·07	80·2	V.G.G.	·64100	8·1246	8·1231	+·0015	8·1238				
	,, ,,	15 19	2·8313	1·18	81·0	+11·8	15·52	81·7	17 34 49	8 56 10	83·7	15·78	81·2	V.G.G.	·64100	8·1195	8·1178	+·0017	8·1186				
	,, 27	12 13	2·8326	1·22	85·3	+11·1	15·26	81·0	17 35 21	8 56 24	84·9	15·23	81·6	G.S.J.	·64117	8·1161	8·1148	+·0013	8·1154				
	,, ,,	15 23	2·8330	1·14	83·4	+11·1	14·72	83·0	17 35 41	8 56 32	84·8	14·92	82·6	G.S.J.	·64108	8·1124	8·1113	+·0011	8·1118				
DECEMBER	4	12 57	2·8322	1·17	81·8	+11·4	15·94	78·9	17 35 22	8 56 20	81·3	15·85	79·7	V.G.G.	·64074	8·1178	8·1171	+·0007	8·1174				
	,, ,,	15 17	2·8326	1·19	79·7	+11·4	15·57	80·4	17 35 40	8 56 30	81·1	15·72	80·2	V.G.G.	·64062	8·1137	8·1128	+·0009	8·1132				
	,, 11	13 11	2·8310	1·19	84·2	+12·0	16·22	79·7	17 34 25	8 55 50	83·8	16·13	80·1	G.S.J.	·64105	8·1246	8·1240	+·0006	8·1243				
	,, ,,	15 23	2·8318	1·25	83·2	+12·0	15·60	81·9	17 34 7	8 55 40	85·4	15·92	80·6	G.S.J.	·64088	8·1210	8·1204	+·0006	8·1207		8·1207		3·7443
	,, 18	12 39	2·8312	1·29	82·3	+12·5	16·52	77·9	17 33 54	8 55 35	83·1	16·38	78·2	V.G.G.	·64062	8·1247	8·1242	+·0005	8·1244				
	,, ,,	15 15	2·8320	1 29	81·6	+12·5	16·08	79·8	17 33 15	8 55 20	86·4	16·23	78·8	V.G.G.	·64052	8·1214	8·1201	+·0013	8·1207				
	,, 25	12 23	2·8305	1·33	83·5	+11·8	16·79	78·5	17 34 9	8 55 48	82·5	16·59	78·8	G.S.J.	·64088	8·1274	8·1261	+·0013	8·1267				
	,, ,,	15 27	2·8322	1·31	83·3	+11·8	15·99	80·7	17 34 41	8 56 5	83·7	16·17	79·5	G.S.J.	·64081	8·1193	8·1176	+·0017	8·1184				

The mean value of the Horizontal Force for the year 1889=8·1197 | 3·7438

* Day of disturbance: observations not reduced.

Absolute Magnetical Observations.—Table V.

Observations of Absolute Declination.

1889.

1889. Date.	Bombay Civil Time.	Mean Readings. Collimator Magnet. Scale apparently Erect.	Inverted.	Horizontal Circle with Telescope pointed to: Scale of Collimator Magnet.	Tárdeo Chimney.	Torsion. Mean.	Effect of 90°.	Observer.	Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination corrected for Torsion.	Monthly Mean. Corresponding Reading of large Declination Magnetometer.	Absolute Easterly Declination.
1	2	3	4	5	6	7	8	9	10	11	12	13
	h. m.	Sc. div.	Sc. div.	° ′ ″	° ′ ″	°	Sc. div.		Sc. div.	° ′ ″	Sc. div.	° ′ ″
JAN. 3	11 20	+1·52	+1·56	17 16 40	196 51 45	0		V. G. G.	36·24	0 51 18	35·96	0 49 35
,, 10	11 25	+1·50	+1·74	17 16 30	196 53 35	0		G. S. J.	35·89	0 49 4		
,, 17	11 29	+1·52	+1·61	17 16 10	196 53 45	0		V. G. G.	35·83	0 48 45		
,, 24	11 25	+1·64	+1·39	17 16 10	196 53 30	15E	0·85	G. S. J..	35·87	0 49 3		
,, 31	11 20	+1·52	+1·65	17 16 40	196 53 15	0		V. G. G.	35·98	0 49 43		
FEB. 7	11 14	+1·54	+1·56	17 15 20	196 52 20	0		G. S. J.	35·94	0 49 25	35·88	0 49 1
,, 14	11 19	+1·52	+1·64	17 14 30	196 51 55	0		V. G. G.	35·85	0 48 53		
,, 21	11 30	+1·46	+1·65	17 14 50	196 52 20	0		G. S. J.	35·84	0 48 44		
MAR. 1	11 21	+1·61	+1·40	17 15 30	196 52 20	0		V. G. G.	36·00	0 49 50	35·95	0 49 38
,, 7	11 17	+1·57	+1·50	17 16 30	196 52 20	0		G. S. J.	36·11	0 50 40		
,, 14	11 21	+1·46	+1·72	17 15 10	196 52 30	0		V. G. G.	35·82	0 48 48		
,, 21	11 39	+1·50	+1·59	17 14 50	196 52 30	0		G. S. J.	35·80	0 48 40		
,, 28	11 23	+1·54	+1·66	17 16 40	196 52 45	0		V. G. G.	36·02	0 50 13		
APRIL 4	11 31	+1·50	+1·67	17 15 20	196 52 50	0		G. S. J.	35·78	0 48 45	35·66	0 47 57
,, 11	11 25	+1·50	+1·71	17 14 0	196 52 25	0		V. G. G.	35·65	0 47 47		
,, 18	11 43	+1·47	+1·71	17 13 45	196 52 40	0		G. S. J.	35·55	0 47 14		
,, 25	11 23	+1·51	+1·65	17 14 20	196 52 32	0		V. G. G.	35·66	0 48 4		
MAY 2	11 21	+1·54	+1·59	17 12 30	196 52 0	0		G. S. J.	35·50	0 46 53	35·61	0 47 39
,, 9	11 39	+1·50	+1·72	17 13 30	196 52 0	0		V. G. G.	35·61	0 47 41		
,, 16	11 21	+1·52	+1·55	17 13 10	196 52 0	0		G. S. J.	35·61	0 47 35		
,, 23	11 36	+1·52	+1·61	17 14 0	196 51 40	0		V. G. G.	35·75	0 48 40		
,, 30	11 22	+1·50	+1·52	17 12 20	196 51 25	10W	0·53	G. S. J.	35·57	0 47 28		
JUNE 6	11 46	+1·52	+1·62	17 13 20	196 51 32	0		V. G. G.	35·66	0 48 7	35·68	0 48 10
,, 13	11 25	+1·55	+1·50	17 12 55	196 51 40	0		G. S. J.	35·62	0 47 44		
,, 20	11 25	+1·51	+1·71	17 13 30	196 51 0	0		V. G. G.	35·77	0 48 42		
,, 27	11 20	+1·62	+1·40	17 11 45	196 50 20	0		G. S. J.	35·67	0 48 6		
JULY 4	11 37	+1·51	+1·64	17 12 40	196 50 27	0		V. G. G.	35·73	0 48 31	35·66	0 48 6
,, 11	11 34	+1·57	+1·49	17 12 5	196 50 35	0		G. S. J.	35·65	0 48 2		
,, 18	11 35	+1·54	+1·61	17 12 25	196 50 22	0		V. G. G.	35·71	0 48 25		
,, 25	11 20	+1·45	+1·70	17 12 45	196 51 35	15W	0·41	G. S. J.	35·54	0 47 28		
AUG. 1	11 34	+1·50	+1·67	17 13 40	196 51 22	0		V. G. G.	35·72	0 48 33	35·58	0 47 36
,, 8	11 20	+1·50	+1·74	17 13 30	196 51 35	0		G. S. J.	35·67	0 48 4		
,, 15	11 34	+1·52	+1·60	17 12 40	196 52 0	0		V. G. G	35·50	0 47 0		
,, 22	11 19	+1·52	+1·66	17 12 10	196 50 50	0		G. S. J.	35·58	0 47 40		
,, 29	11 24	+1·46	+1·70	17 12 0	196 51 20	0		V. G. G.	35·43	0 46 45		
SEPT. 5	11 20	+1·45	+1·71	17 12 0	196 52 10	20W	0·50	G. S. J.	35·38	0 46 13	35·46	0 46 54
,, 12	11 34	+1·47	+1·74	17 12 20	196 51 40	0		V. G. G.	35·46	0 46 48		
,, 19	11 25	+1·45	+1·70	17 12 10	196 51 15	0		G. S. J.	35·48	0 47 4		
,, 26	11 34	+1·46	+1·69	17 13 0	196 51 40	0		V. G. G.	35·54	0 47 31		
OCT. 3	11 23	+1·51	+1·61	17 12 40	196 51 25	0		G. S. J.	35·56	0 47 34	35·60	0 48 1
,, 10	11 20	+1·51	+1·72	17 11 30	196 51 0	0		V. G. G.	35·42	0 46 42		
,, 17	11 20	+1·50	+1·65	17 14 30	196 51 47	0		G. S. J.	35·74	0 48 59		
,, 24	11 35	+1·51	+1·64	17 14 5	196 52 15	0		V. G. G.	35·60	0 48 8		
,, 31	11 20	+1·57	+1·49	17 14 20	196 52 12	0		G. S. J.	35·70	0 48 40		
NOV. 7	11 27	+1·59	+1·49	17 14 20	196 52 20	0		V. G. G.	35·69	0 48 33	35·61	0 47 50
,, 14	11 18	+1·52	+1·55	17 14 20	196 53 0	0		G. S. J.	35·59	0 47 45		
,, 21	11 20	+1·54	+1·50	17 14 30	196 53 7	0		V. G. G.	35·60	0 47 48		
,, 28	11 20	+1·56	+1·55	17 13 45	196 52 55	0		G. S. J.	35·55	0 47 16		
DEC. 5	11 23	+1·50	+1·70	17 14 40	196 52 32	0		V. G. G.	35·72	0 48 20	35·72	0 48 14
,, 12	11 20	+1·55	+1·60	17 15 40	196 53 10	15E	0·99	G. S. J.	35·76	0 48 30		
,, 19	11 34	+1·50	+1·65	17 15 20	196 53 5	0		V. G. G.	35·77	0 48 31		
,, 26	11 40	+1·04	+1·37	17 14 30	196 53 40	0		G. S. J.	35·65	0 47 34		

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The Mean Declination for the year 1889 = 0 48 13

Absolute Magnetical Observations.—Table VI.

OBSERVATIONS OF INCLINATION, 1889.

Taken with Barrow's Dip Circle, with Microscopes, No 49 and two 3½-inch Needles Nos. 1 and 2 by Dover, Charlton.

1889. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	12 43	14 12	G.S.J.	2	20 23·4	20 53·0	19 46·7	20 14·4	20 19·4		
„ 4	14 50	16 30	V.G.G.	1	20 31·1	20 53·2	19 30·1	20 8·9	20 15·8	No. 2	
„ 8	12 23	13 43	G.S.J.	1	20 37·2	21 0·6	19 34·5	20 6·4	20 19·7	0 ′	
„ 11	14 32	15 55	G.S.J.	2	20 22·1	20 54·1	19 45·8	20 16·2	20 19·5	20 18·3	
„ 15	12 15	13 55	V.G.G.	2	20 21·9	20 52·6	19 44·4	20 15·6	20 18·6		20 19·4
„ 18	14 50	16 20	V.G.G.	1	20 35·4	21 13·2	19 38·6	19 59·7	20 21·7	No. 1	
„ 22	12 20	13 45	G.S.J.	1	20 41·7	21 21·2	19 34·1	20 6·1	20 25·8	0 ′	
„ 25	14 34	15 53	G.S.J.	2	20 20·2	20 45·6	19 49·3	20 15·2	20 17·6	20 20·7	
„ 29	12 20	13 55	V.G.G.	2	20 20·5	20 48·2	19 43·4	20 14·5	20 16·6		
FEB. 1	14 50	16 30	V.G.G.	1	20 37·0	21 4·2	19 42·4	20 6·6	20 22·5	No. 2	
„ 5	12 15	13 36	G.S.J.	1	20 35·5	20 59·7	19 38·6	20 3·2	20 19·2	0 ′	
„ 8	14 26	15 46	G.S.J.	2	20 20·8	20 47·6	19 49·7	20 17·1	20 18·8	20 18·1	
„ 12	12 20	13 55	V.G.G.	2	20 18·5	20 46·6	19 55·1	20 15·4	20 18·9		20 19·4
„ 15	14 42	16 23	V.G.G.	1	20 41·6	21 2·1	19 38·2	20 4·5	20 21·6	No. 1	
„ 19	12 17	13 42	G.S.J.	1	20 35·3	21 1·8	19 38·4	20 3·3	20 19·7	0 ′	
„ 22	14 30	15 55	G.S.J.	2	20 22·1	20 43·0	19 53·2	20 13·0	20 17·8	20 20·7	
„ 26	12 18	13 53	V.G.G.	2	20 20·0	20 40·5	19 57·9	20 10·0	20 17·1		
MARCH 1	14 50	16 15	V.G.G.	1	20 34·7	20 57·7	19 39·7	20 3·5	20 18·9		
„ 5	12 15	13 38	G.S.J.	1	20 28·5	20 57·5	19 34·0	20 0·4	20 15·1	No. 2	
„ 8	14 45	16 11	G.S.J.	2	20 25·7	20 47·4	19 38·4	20 11·6	20 15·8	0 ′	
„ 12	12 20	13 50	V.G.G.	2	20 23·0	20 48·6	19 45·9	20 14·2	20 17·9	20 17·2	
„ 15	14 50	16 17	V.G.G.	1	20 33·5	20 55·9	19 38·7	20 5·4	20 18·4		20 17·0
„ 19	12 17	13 36	G.S.J.	1	20 30·5	20 55·0	19 36·0	20 1·7	20 15·8	No. 1	
„ 22	14 37	16 1	G.S.J.	2	20 21·5	20 48·0	19 51·4	20 13·6	20 18·6	0 ′	
„ 26	12 10	13 40	V.G.G.	2	20 22·2	20 43·9	19 45·2	20 14·2	20 16·4	20 16·8	
„ 29	14 59	16 20	V.G.G.	1	20 30·5	20 56·2	19 34·6	20 2·4	20 15·9		
APRIL 2	12 18	13 40	G.S.J.	1	20 32·2	20 54·5	19 37·7	20 0·6	20 16·2		
„ 5	14 40	16 2	G.S.J.	2	20 22·6	20 41·2	19 51·9	20 11·6	20 16·8	No. 2	
„ 8	12 20	13 50	V.G.G.	2	20 16·1	20 41·1	19 49·7	20 14·0	20 15·2	0 ′	
„ 12	14 46	16 12	V.G.G.	1	20 34·6	20 57·7	19 31·1	20 4·0	20 16·8	20 15·8	
„ 16	12 24	13 49	G.S.J.	1	20 34·6	20 53·7	19 41·2	19 58·8	20 17·1		20 16·6
„ 19	15 15	16 30	V.G.G.	2	20 18·0	20 41·9	19 48·7	20 12·5	20 15·3	No. 1	
„ 23	12 4	13 16	C.	2	20 17·0	20 42·4	19 52·3	20 12·7	20 16·1	0 ′	
„ 26	14 50	16 15	V.G.G.	1	20 29·6	20 56·4	19 40·9	20 5·4	20 18·1	20 17·1	
„ 30	12 20	13 43	G.S.J.	1	20 27·9	20 58·6	19 36·6	20 6·9	20 17·5		
MAY 3	14 30	15 59	G.S.J.	2	20 15·0	20 48·8	19 48·8	20 19·7	20 18·1		
„ 7	12 17	13 45	V.G.G.	2	20 15·7	20 57·5	19 46·1	20 18·7	20 19·5	No. 2	
„ 10	14 55	16 15	V.G.G.	1	20 30·7	20 53·2	19 39·6	20 5·7	20 17·3	0 ′	
„ 14	12 17	13 39	G.S.J.	1	20 34·6	20 56·9	19 37·9	20 5·9	20 18·8	20 18·3	
„ 17	14 36	15 57	G.S.J.	2	20 16·2	20 50·3	19 47·2	20 19·3	20 18·2		20 18·4
„ 21	12 18	13 40	V.G.G.	2	20 14·5	20 45·5	19 48·2	20 18·2	20 16·6	No. 1	
„ 25	14 52	16 19	V.G.G.	1	20 31·2	21 0·6	19 36·4	20 5·5	20 18·4	0 ′	
„ 28	12 27	13 48	G.S.J.	1	20 31·6	20 57·7	19 43·7	20 6·2	20 19·8	20 18·6	
„ 31	14 34	15 56	G.S.J.	2	20 20·5	20 43·1	19 53·6	20 18·9	20 19·0		

1889. Date.	Bombay Civil Time (0 to 24 hours). At commencement. h.	m.	At conclusion. h.	m.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East. °	'	West. °	'	B. Face of Circle. East. °	'	West. °	'	Mean Dip. °	'	Monthly Mean for each Needle.		Monthly Mean. °	'
June 4	12	30	13	50	V.G.G.	2	20	21·5	20	49·1	19	51·5	20	23.2	20	21·3				
„ 7	14	55	16	10	V.G.G.	1	20	27·7	21	1·1	19	37·5	20	8·7	20	18·8	No.	2		
„ 11	12	10	13	33	G.S.J.	1	20	33·3	20	53·4	19	45·0	20	4·1	20	18·9	°	'		
„ 14	14	35	15	55	G.S.J.	2	20	26·6	20	48·3	19	52·1	20	19·1	20	21·5	20	19·6		
„ 18	12	20	13	50	V.G.G.	2	20	14·5	20	44·9	19	49·7	20	21·1	20	17·5			20	19·5
„ 21	14	59	16	20	V.G.G.	1	20	28·7	21	0·2	19	43·2	20	7·0	20	19·8	No.	1		
„ 25	12	24	13	48	G.S.J.	1	20	41·4	20	55·8	19	43·1	20	1·0	20	20·3	°	'		
„ 28	14	43	16	5	G.S.J.	2	20	22·3	20	40·9	19	54·4	20	14.6	20	18 0	20	19·4		
July 2	12	20	13	47	V.G.G.	2	20	19·5	20	46·4	19	46·9	20	14·2	20	16·7				
„ 5	14	55	16	25	V.G.G.	1	20	32·7	20	58·7	19	43·0	20	3·6	20	19·5	No.	2		
„ 9	12	11	13	38	G.SJ.	1	20	34·8	20	54·0	19	37·1	19	57·1	20	15·7	°	'		
„ 12	14	40	16	0	G.S.J.	2	20	23·8	20	43·4	19	52·9	20	12·7	20	18·2	20	18·4		
„ 16	12	10	13	45	V.G.G.	2	20	21·0	20	46·4	19	47·0	20	16·0	20	17·6			20	18·5
„ 19	14	54	16	14	V.G.G.	1	20	33·5	20	57·2	19	36·9	20	2·1	20	17·4	No.	1		
„ 23	12	18	13	38	G.S.J.	1	20	38·4	20	57·6	19	47·4	20	3·1	20	21·6	°	'		
„ 26	14	45	16	6	G.S.J.	2	20	27·6	20	46·1	19	54·7	20	14·4	20	20·7	20	18·5		
„ 30	12	20	13	44	V.G.G.	2	20	19·6	20	54·2	19	44·4	20	16·7	20	18·7				
August 2	14	50	16	10	V.G.G.	1	20	33·6	21	0·6	19	42·5	20	1·7	20	19·6				
„ 6	12	16	13	35	G.S.J.	1	20	38·7	20	55·8	19	39·6	19	58·0	20	18·0	No.	2		
„ 9	14	40	16	2	G.S.J.	2	20	25·9	20	48·5	19	53·4	20	12·7	20	20·1	°	'		
„ 13	12	18	13	42	V.G.G.	2	20	18·7	20	50·5	19	50·7	20	15·5	20	18·8	20	19·7		
„ 16	15	0	16	17	V.G.G.	1	20	31·5	21	7·6	19	35·1	20	3·7	20	19·5			20	19·4
„ 20	12	6	13	35	G.S.J.	1	20	38·7	20	54·6	19	43·9	20	0·6	20	19·4				
„ 23	14	35	16	3	G.S.J.	2	20	29·7	20	46·1	19	54·5	20	12·1	20	20·6	No.	1		
„ 27	12	20	13	45	V.G.G.	2	20	21·4	20	53·9	19	46·7	20	16·1	20	19·5	°	'		
„ 31	14	55	16	13	G.S.J.	1	20	38·5	20	58·6	19	42·6	19	58·1	20	19·4	20	19·2		
Sept. 3	12	14	13	36	G.S.J.	1	20	32·5	20	53·5	19	41·1	19	59·1	20	16·5	No.	2		
„ 6	14	44	16	5	G.S.J.	2	20	25·3	20	45·1	19	55·6	20	14·2	20	20·0	°	'		
„ 10	12	15	13	40	V.G.G.	2	20	13·7	20	54·5	19	46·5	20	24·5	20	19·8	20	19·6		
„ 13	14	50	16	8	V.G.G.	1	20	38·2	21	8·1	19	35·2	20	0·1	20	20·4				
„ 17	12	17	13	42	G.S.J.	1	20	36·7	20	54·1	19	45·6	20	2·7	20	19·8			20	19·2
„ 20	14	50	16	13	G.S.J.	2	20	28·7	20	44·5	19	52·6	20	14·7	20	20·1	No.	1		
„ 24	12	25	13	49	V.G.G.	2	20	17·6	20	52·4	19	48·7	20	15·1	20	18·4	°	'		
„ 27	14	50	16	5	V.G.G.	1	20	34·6	20	57·9	19	41·5	20	2·0	20	19·0	20	18·9		
Oct. 1	12	12	13	33	G.S.J.	1	20	36·2	20	51·4	19	46·5	20	1·3	20	18·8	No.	2		
„ 5	14	43	16	5	G.S.J.	2	20	30·6	20	33·9	20	7·9	19	57·6	20	17·5	°	'		
„ 8	12	33	14	0	V.G.G.	2	20	30·0	20	36·7	19	56·1	20	8·4	20	17·8	20	19·0		
„ 11	14	54	16	20	V.G.G.	1	20	32·7	20	57·0	19	41·4	20	5·2	20	19·1				
„ 15	12	15	13	37	G.S.J.	1	20	39·1	20	53·1	19	44·2	19	59·4	20	18·9			20	18·9
„ 18	14	38	16	0	G.S.J.	2	20	29·8	20	45·9	19	56·7	20	13·0	20	21·3				
„ 21	12	20	13	51	V.G.G.	2	20	25·0	20	53·2	19	51·7	20	7·5	20	19·3	No.	1		
„ 26	14	55	16	15	V.G.G.	1	20	27·6	21	5·4	19	41·0	19	57·7	20	17·9	°	'		
„ 29	12	24	13	46	G.S.J.	1	20	35·7	20	52·4	19	47·6	20	2·6	20	19·6	20	18·9		

1889. Date.	Bombay Civil Time (0 to 24 hours). At commencement.		At conclusion.		Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.		End of Needle Dipping. A. Face of Circle. West.		End of Needle Dipping. B. Face of Circle. East.		End of Needle Dipping. B. Face of Circle. West.		Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h.	m.	h.	m.			°	′	°	′	°	′	°	′	°	′		
Nov. 1	14	42	16	5	G.S.J.	2	20	22·4	20	57·6	19	47·6	20	16·5	20	21·0	No. 2	
„ 5	12	20	13	43	V.G.G.	2	20	20·2	20	56·1	19	41·0	20	24·9	20	20·5		
„ 8	14	53	16	10	V.G.G.	1	20	33·9	21	1·0	19	39·0	20	2·1	20	19·0	20	20·5
„ 12	12	25	13	42	G.S.J.	1	20	36·0	20	59·2	19	48·0	20	2·9	20	21·5		
„ 15	14	48	16	6	G.S.J.	2	20	25·4	20	48·4	19	56·7	20	14·7	20	19·5		20 20·5
„ 19	12	28	13	50	V.G.G.	2	20	23·2	20	53·0	19	46·9	20	25·9	20	19·7		
„ 22	14	45	16	3	G.S.J.	1	20	38·5	20	56·7	19	48·6	20	3·9	20	21·9	No. 1	
„ 26	12	20	13	36	G.S.J.	1	20	37·7	20	53·6	19	46·1	20	1·1	20	19·6		
„ 29	14	40	15	57	G.S.J.	2	20	29·2	20	45·4	19	56·6	20	16·1	20	21·8	20	20·5
Dec. 3	12	27	13	58	V.G.G.	2	20	28·9	20	41·9	19	54·6	20	16·9	20	20·6		
„ 6	14	58	16	20	V.G.G.	1	20	31·0	20	57·5	19	46·4	20	2·1	20	19·2	No. 2	
„ 10	12	25	13	45	G.S.J.	1	20	38·3	20	57·7	19	46·0	20	2·4	20	21·1		
„ 13	14	40	15	58	G.S.J.	2	20	25·3	20	44·1	19	55·5	20	13·1	20	20·5	20	20·5
„ 17	12	20	13	50	V.G.G.	2	20	28·6	20	46·5	19	48·0	20	23·1	20	21·5		20 20·5
„ 20	14	55	16	25	V.G.G.	1	20	40·0	21	2·1	19	40·1	20	4·1	20	21·6		
„ 24	12	20	13	42	G.S.J.	1	20	42·7	20	52·2	19	50·0	19	55·7	20	20·1	No. 1	
„ 27	14	40	16	0	G.S.J.	2	20	28·9	20	46·9	19	53·2	20	15·5	20	21·1		
„ 31	12	59	13	40	V.G.G.	2	20	24·2	20	43·9	19	48·5	20	28·6	20	18·8	20	20·5

The Mean Dip for the year ...	With Needle No. 1	=	° 20 ′ 19·1
	With Needle No. 2	=	20 18·7

The Mean Dip for the year 1889 = ° 20 ′ 18·9

Absolute Magnetical Observations.—Table VI *a*.

SUPPLEMENTARY OBSERVATIONS OF INCLINATION, 1889.

Taken with Barrow's Dip Circle, with Microscopes, No. 49 and two 3½-inch Needles, Nos. $\frac{1}{81}$ and $\frac{2}{81}$ by John Dover.

1889. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
JAN. 1	11 46	15 17	G.S.J.	$\frac{2}{81}$	19 52·1	19 57·2	19 52·2	20 41·2	20 5·7		
,, 4	13 40	17 20	V.G.G.	$\frac{1}{81}$	19 56·1	20 21·0	20 20·7	20 26·2	20 16·0	No. $\frac{2}{81}$	
,, 8	11 30	14 38	G.S.J.	$\frac{1}{81}$	20 1·2	20 22·7	20 9·9	20 18·6	20 13·1	° 20 11·6	
,, 11	13 42	16 52	G.S.J	$\frac{2}{81}$	19 56·7	19 57·2	20 14·2	20 45·4	20 13·4		
,, 15	11 25	14 55	V.G.G.	$\frac{2}{81}$	19 38·6	20 12·6	20 11·9	20 41·4	20 11·1		20 13·0
,, 18	13 58	17 27	V.G.G.	$\frac{1}{81}$	19 59·1	20 24·6	20 4·4	20 24·7	20 13·2		
,, 22	11 25	14 40	G.S.J.	$\frac{1}{81}$	19 58·6	20 22·9	19 46·6	20 57·8	20 16·5	No. $\frac{1}{81}$	
,, 25	13 40	16 45	G.S.J.	$\frac{2}{81}$	19 56·0	20 17·3	20 3·4	20 44·2	20 15·2	° 20 14·7	
,, 29	11 30	14 50	V.G.G.	$\frac{2}{81}$	19 49·0	20 16·4	19 59·1	20 46·4	20 12·7		
FEB. 1	13 55	17 25	V.G.G.	$\frac{1}{81}$	20 2·5	20 36·1	19 58·7	20 34·4	20 17·9	No. $\frac{2}{81}$	
,, 5	11 20	14 30	G.S.J.	$\frac{1}{81}$	20 0·5	20 22·4	20 13·6	20 52·7	20 22·3	° 20 14·4	
,, 8	13 35	16 42	G.S.J.	$\frac{2}{81}$	19 43·8	20 4·4	20 5·1	20 54·6	20 12·0		
,, 12	11 25	14 45	V.G.G.	$\frac{2}{81}$	20 8·4	19 55·7	19 57·7	20 48·1	20 12·5		20 17·3
,, 15	13 45	17 32	V.G.G.	$\frac{1}{81}$	19 59·5	20 25·1	20 16·2	20 32·9	20 18·4		
,, 19	11 23	14 38	G.S.J.	$\frac{1}{81}$	20 2·7	20 19·9	20 16·4	20 51·6	20 22·6	No. $\frac{1}{81}$	
,, 22	13 40	16 52	G.S.J.	$\frac{2}{81}$	20 2·7	20 20·4	20 0·6	20 49·7	20 18·3	° 20 20·3	
,, 26	11 23	14 55	V.G.G.	$\frac{2}{81}$	19 58·2	20 2·2	20 7·4	20 51·6	20 14·8		
MARCH 1	13 50	17 5	V.G.G.	$\frac{1}{81}$	20 11·5	20 24·1	20 2·4	20 38·4	20 19·1		
,, 5	11 18	14 33	G.S.J.	$\frac{1}{81}$	19 59·6	20 27·8	20 7·4	20 53·9	20 22·2	No. $\frac{2}{81}$	
,, 8	13 50	17 4	G.S.J.	$\frac{2}{81}$	19 56·5	20 14·1	19 57·9	20 43·7	20 13·0	° 20 14·0	
,, 12	11 30	14 45	V.G.G.	$\frac{2}{81}$	19 56·8	20 17·6	19 57·9	20 48·5	20 15·2		
,, 15	14 0	17 5	V.G.G.	$\frac{1}{81}$	20 2·2	20 26·2	20 11·0	20 48·9	20 22·1		20 18·1
,, 19	11 20	14 45	G.S.J.	$\frac{1}{81}$	20 9·9	20 20·2	20 11·6	20 47·7	20 22·3		
,, 22	13 42	16 55	G.S.J.	$\frac{2}{81}$	19 33·5	20 16·5	20 7·2	20 47·4	20 11·1	No. $\frac{1}{81}$	
,, 26	11 25	14 35	V.G.G.	$\frac{2}{81}$	19 55·5	20 19·5	19 59·9	20 51·4	20 16·6	° 20 21·4	
,, 29	14 10	17 15	V.G.G.	$\frac{1}{81}$	20 5·6	20 29·5	20 16·4	20 33·6	20 21·3		
APRIL 2	11 25	14 35	G.S.J.	$\frac{1}{81}$	20 4·6	20 16·2	20 16·1	20 32·6	20 17·4		
,, 5	13 45	16 55	G.S.J.	$\frac{2}{81}$	19 59·2	20 14·9	19 59·6	20 41·7	20 13·8	No. $\frac{2}{81}$	
,, 8	11 30	14 45	V.G.G.	$\frac{2}{81}$	19 53·7	20 22·7	20 4·9	20 43·7	20 16·2	° 20 14·4	
,, 12	14 0	17 8	V.G.G.	$\frac{1}{81}$	20 0·0	20 24·0	20 12·1	20 32·0	20 17·0		
,, 16	11 28	14 40	G.S.J.	$\frac{1}{81}$	20 3·4	20 22·9	20 14·4	20 30·1	20 17·7		20 16·1
,, 19	14 20	17 23	V.G.G.	$\frac{2}{81}$	20 0·2	20 7·2	19 56·2	20 48·2	20 12·9		
,, 23	11 14	14 5	C.	$\frac{2}{81}$	20 2·5	20 5·3	20 2·6	20 48·3	20 14·7	No. $\frac{1}{81}$	
,, 26	14 0	17 10	V.G.G.	$\frac{1}{81}$	20 3·6	20 23·9	20 11·4	20 27·6	20 16·6	° 20 17·4	
,, 30	11 28	14 38	G.S.J.	$\frac{1}{81}$	20 3·1	20 26·2	20 8·3	20 36·5	20 18·5		

1889. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
MAY 3	13 35	16 54	G.S.J.	$\frac{2}{81}$	19 42·9	20 24·9	19 57·1	20 49·5	20 13·6		
,, 7	11 25	14 30	V.G.G.	$\frac{2}{81}$	19 58·5	20 24·5	19 50·4	20 49·0	20 15·6	No. $\frac{2}{81}$	
,, 10	14 0	17 8	V.G.G.	$\frac{1}{81}$	19 55·4	20 25·4	20 7·7	20 54·5	20 20·7	° ′ 20 14·3	
,, 14	11 27	14 31	G.S.J.	$\frac{1}{81}$	19 57·9	20 27·9	20 7·7	20 54·8	20 22·1		
,, 17	13 46	16 52	G.S.J.	$\frac{2}{81}$	19 42·6	20 12·6	19 57·7	20 49·4	20 10·6		20 17·6
,, 21	11 25	14 32	V.G.G.	$\frac{2}{81}$	19 52·7	20 22·7	19 58·7	20 42·0	20 14·0		
,, 25	14 2	17 7	V.G.G.	$\frac{1}{81}$	19 58·6	20 28·7	20 12·1	20 46·2	20 21·4	No. $\frac{1}{81}$	
,, 28	11 38	14 52	G.S.J.	$\frac{1}{81}$	20 0·2	20 30·7	20 13·3	20 46·1	20 22·6	° ′ 20 21·7	
,, 31	13 44	16 49	G.S.J.	$\frac{2}{81}$	19 50·7	20 10·4	20 12·7	20 57·1	20 17·7		
JUNE 4	11 40	14 35	V.G.G.	$\frac{2}{81}$	19 49·7	20 18·2	20 9·4	20 54·2	20 17·9	No. $\frac{2}{81}$	
,, 7	13 50	17 5	V.G.G.	$\frac{1}{81}$	19 47·0	20 30·6	20 10·9	20 49·1	20 19·4	° ′ 20 17·5	
,, 11	11 17	14 30	G.S.J.	$\frac{1}{81}$	19 59·7	20 24·1	20 7·0	20 54·2	20 21·2		
,, 14	13 45	16 53	G.S.J.	$\frac{2}{81}$	19 53·2	20 10·7	20 16·9	20 49·4	20 17·5		20 19·3
,, 18	11 25	14 45	V.G.G.	$\frac{2}{81}$	19 49·6	20 17 0	20 10·7	20 50·2	20 16·9		
,, 21	14 6	17 10	V.G.G.	$\frac{1}{81}$	19 56·7	20 27·7	20 8·4	20 45·1	20 19·5	No. $\frac{1}{81}$	
,, 25	11 31	14 44	G.S.J.	$\frac{1}{81}$	19 58·7	20 26·2	20 9·9	21 1·6	20 24·1	° ′ 20 21·0	
,, 28	13 54	17 3	G.S.J.	$\frac{2}{81}$	19 59·0	20 18·1	19 57·7	20 56·8	20 17·9		
JULY 2	11 32	14 35	V.G.G.	$\frac{2}{81}$	19 54·2	20 10·5	20 2·1	20 58·7	20 16·4		
,, 5	14 1	17 15	V.G.G.	$\frac{1}{81}$	20 0·5	20 28·6	20 4·2	20 51·6	20 21·2	No. $\frac{2}{81}$	
,, 9	11 22	14 33	G.S.J.	$\frac{1}{81}$	19 59·6	20 24·4	20 11·9	20 49·1	20 21·2	° ′ 20 16·4	
,, 12	13 50	16 57	G.S.J.	$\frac{2}{81}$	19 53·9	20 8·4	19 56·3	21 0·7	20 14·8		
,, 16	11 20	14 37	V.G.G.	$\frac{2}{81}$	19 58·1	20 5·2	19 57·0	20 59·2	20 14·9		20 18·4
,, 19	14 4	17 8	V.G.G.	$\frac{1}{81}$	20 0·0	20 28·9	20 12·7	20 44·9	20 21·6		
,, 23	11 25	14 36	G.S.J.	$\frac{1}{81}$	20 1·2	20 25·1	20 15·4	20 38·1	20 19·9	No. $\frac{1}{81}$	
,, 26	13 50	17 3	G.S.J.	$\frac{2}{81}$	20 1·8	20 23·2	20 1·3	20 49·0	20 18·8	° ′ 20 21·0	
,, 30	11 30	14 32	V.G.G.	$\frac{2}{81}$	19 47·1	20 10·1	20 11·9	20 58·5	20 16·9		
AUG. 2	13 58	17 4	V.G.G.	$\frac{1}{81}$	19 57·4	20 26·2	20 9·9	20 49·4	20 20·7		
,, 6	11 25	14 32	G.S.J.	$\frac{1}{81}$	20 0·3	20 23·3	20 12·1	20 36·9	20 18·1	No. $\frac{2}{81}$	
,, 9	13 48	16 59	G.S.J.	$\frac{2}{81}$	20 1·2	20 29·9	20 0·7	20 50·7	20 20·6	° ′ 20 18·7	
,, 13	11 25	14 30	V.G.G.	$\frac{2}{81}$	19 50·7	20 13·2	20 7·1	20 57·7	20 17·2		
,, 16	14 2	17 12	V.G.G.	$\frac{1}{81}$	19 59·3	20 31·4	20 11·1	20 34·5	20 19·1		20 19·1
,, 20	11 17	14 33	G.S.J.	$\frac{1}{81}$	20 2·9	20 25·6	20 13·2	20 33·5	20 18·8		
,, 23	13 45	17 0	G.S.J.	$\frac{2}{81}$	20 2·6	20 19·8	20 2·9	20 55·3	20 20·1	No. $\frac{1}{81}$	
,, 27	11 25	14 38	V.G.G.	$\frac{2}{81}$	19 50·7	20 11·1	20 11·7	20 54·5	20 17·0	° ′ 20 19·4	
,, 31	13 58	17 12	G.S.J.	$\frac{1}{81}$	20 2·9	20 26·4	20 15·1	20 37·5	20 20·5		

1889. Date.	Bombay Civil Time (0 to 24 hours). At commencement.	At conclusion.	Observer.	Needle marked.	End of Needle Dipping. A. Face of Circle. East.	A. Face of Circle. West.	B. Face of Circle. East.	B. Face of Circle. West.	Mean Dip.	Monthly Mean for each Needle.	Monthly Mean.
	h. m.	h. m.			° ′	° ′	° ′	° ′	° ′		° ′
SEPT. 3	11 20	14 31	G.S.J.	1/81	20 2·7	20 25·6	20 13·6	20 33·9	20 18·9		
,, 6	13 50	17 5	G.S.J.	2/81	19 50·1	20 8·2	20 6·6	20 44·6	20 12·4	No. 2/81	
,, 10	11 30	14 35	V.G.G.	2/81	19 48·2	20 24·1	19 57·1	20 54·0	20 15·8	20 16·1	
,, 13	13 55	17 4	V.G.G.	1/81	20 5·7	20 27·0	20 10·9	20 39·0	20 20·6		20 18·0
,, 17	11 22	14 42	G.S.J.	1/81	20 2·1	20 28·4	20 16·1	20 32·9	20 19·9		
,, 20	13 58	17 7	G.S.J.	2/81	19 53·3	20 19·9	20 1·9	20 59·4	20 18·6	No. 1/81	
,, 24	11 35	14 37	V.G.G.	2/81	19 49·2	20 20·0	20 5·7	20 56·5	20 17·8	20 19·9	
,, 27	14 0	17 0	V.G.G.	1/81	20 1·5	20 28·6	20 15·4	20 35·9	20 20·3		
OCT. 1	11 21	14 32	G.S.J.	1/81	20 1·5	20 19·5	20 15·9	20 33·7	20 17·6		
,, 5	13 50	16 58	G.S.J.	2/81	20 7·5	20 17·2	20 5·1	20 44·5	20 18·6	No. 2/81	
,, 8	11 29	14 48	V.G.G.	2/81	19 59·1	20 22·7	20 7·4	20 49·7	20 19·7	20 17·7	
,, 11	14 0	17 15	V.G.G.	1/81	19 59·6	20 21·5	20 11·4	20 36·7	20 17·3		
,, 15	11 22	14 35	G.S.J.	1/81	20 4·1	20 29·3	20 11·5	20 34·3	20 19·8		20 18·2
,, 18	13 48	17 0	G.S.J.	2/81	19 59·8	20 17·4	20 6·9	20 41·4	20 16·4		
,, 21	11 29	14 45	V.G.G.	2/81	19 59·2	20 22·7	19 58·6	20 44·9	20 16·3	No. 1/81	
,, 26	14 0	17 7	V.G.G.	1/81	20 1·5	20 30·2	20 7·7	20 36·1	20 18·9	20 18·5	
,, 29	11 30	14 40	G.S.J.	1/81	20 1·6	20 26·1	20 13·6	20 33·9	20 18·8		
NOV. 1	13 50	17 7	G.S.J.	2/81	20 5·2	20 19·2	20 7·5	20 44·9	20 19·2		
,, 5	11 31	14 35	V.G.G.	2/81	19 52·7	20 16·7	20 13·2	20 51·2	20 18·4	No. 2/81	
,, 8	14 7	17 2	V.G.G.	1/81	20 1·0	20 31·5	20 8·5	20 35·4	20 19·1	20 20·0	
,, 12	11 32	14 40	G.S.J.	1/81	20 5·1	20 27·1	20 6·5	20 53·8	20 23·1		
,, 15	13 55	16 59	G.S.J.	2/81	20 4·9	20 24·9	20 7·9	20 50·3	20 22·0		20 21·1
,, 19	11 35	14 38	V.G.G.	2/81	20 2·1	20 26·0	20 7·2	20 52·0	20 21·8		
,, 22	13 55	17 0	G.S.J.	1/81	20 6·7	20 30·2	20 12·7	20 53·4	20 25·7	No. 1/81	
,, 26	11 28	14 32	G.S.J.	1/81	20 5·4	20 26·4	20 14·6	20 42·4	20 22·2	20 22·5	
,, 29	13 50	16 58	G.S.J.	2/81	19 57·1	20 17·5	20 13·0	20 45·9	20 18·4		
DEC. 3	11 32	14 50	V.G.G.	2/81	19 57·7	20 15·7	20 6·2	20 51·0	20 17·6		
,, 6	14 2	17 15	V.G.G.	1/81	20 0·2	20 30·7	20 9·5	20 43·7	20 21·0	No. 2/81	
,, 10	11 30	14 40	G.S.J.	1/81	20 5·2	20 29·4	20 13·4	20 33·2	20 20·3	20 19·3	
,, 13	13 48	16 58	G.S.J.	2/81	20 5·6	20 16·9	20 19·1	20 43·0	20 21·1		
,, 17	11 30	14 45	V.G.G.	2/81	19 59·4	20 19·2	20 22·2	20 40·0	20 20·2		20 19·9
,, 20	14 0	17 1	V.G.G.	1/81	20 3·5	20 27·4	20 10·1	20 37·0	20 19·5		
,, 24	11 25	14 36	G.S.J.	1/81	20 5·6	20 31·6	20 14·5	20 35·6	20 21·8	No. 1/81	
,, 27	13 46	16 59	G.S.J.	2/81	20 5·8	20 26·0	20 2·5	20 45·6	20 20·0	20 20·6	
,, 31	11 5	14 25	V.G.G.	2/81	20 3·0	20 21·1	19 58·4	20 47·9	20 17·6		

The Mean Dip for the year ... { With Needle No. 2/81 = 20 16·2 ; With Needle No. 1/81 = 20 19·9

The Mean Dip for the year 1889 = 20 18·0

Absolute Magnetical Observations.—Table VI *b*.

TRIAL OBSERVATIONS OF INCLINATION.

Taken with Barrow's Dip Circle, with Microscopes, No. 49—during the intervals between times when it was being taken to pieces, cleaned, and re-adjusted—and with several 3½-inch Needles.

Date.	Bombay Civil Time (0 to 24 hours).		Observer.	End of Needle Dipping.				Mean Dip.
				A.		B.		
	At commencement.	At conclusion.		Face of Circle.		Face of Circle.		
				East.	West.	East.	West.	
Needle by John Dover No. $\frac{1}{81}$.								
	h. m.	h. m.		° ′	° ′	° ′	° ′	° ′
1887 Dec. 9	14 36	17 36	P.	20 27·7	19 2·0	20 59·7	19 7·2	19 54·1
„ „ 13	13 23	17 13	G. S. J.	21 35·2	18 29·1	21 2·5	18 37·6	19 56·1
„ „ 19	15 40	17 18	V. N.	20 8·4	20 5·4	20 18·9	20 18·2	20 12·7
„ „ 23	13 50	17 30	P.	20 9·4	20 8·1	20 0·9	20 35·6	20 13·5
„ „ 27	11 24	15 5	G. S. J.	20 18·7	20 4·2	20 5·7	20 11·5	20 10·0
Needle by Adie No. 5.								
1887 Dec. 16	13 57	17 55	G. S. J.	21 1·5	16 12·7	24 44·0	16 2·6	19 30·2
„ „ 20	11 37	15 15	P.	19 33·4	19 25·1	21 4·4	20 47·7	20 12·6
„ „ 22	14 52	17 5	V. N.	19 28·7	19 0·1	22 15·6	21 15·0	20 29·8
„ „ 30	12 6	15 57	C.	19 29·7	18 46·6	21 6·9	20 49·5	20 3·2
Needle by John Dover No. $\frac{2}{81}$.								
1887 Dec. 19	12 20	14 4	V. N.	20 24·0	19 46·9	20 5·1	20 29·2	20 11·3
Needle by John Dover No. 2.								
1887 Dec. 20	16 2	17 50	V. N.	20 23·7	20 10·2	19 40·0	19 26·4	19 55·1
Needle by Dover, Charlton No. 1.								
1888 Dec. 29	11 0	12 44	C. C.	20 27·6	21 7·2	19 12·9	20 8·6	20 14·1
1889 Jan. 3	13 55	15 38	V. N.	20 42·8	21 6·7	19 32·6	20 20·6	20 25·7
Needle by Dover, Charlton No. 2.								
1888 Dec. 30	12 18	13 16	C. C.	20 12·6	20 53 0	19 45·4	20 20·4	20 17·8
1889 Jan. 3	16 10	18 10	V. N.	20 19 3	20 40·1	19 48·0	20 3·7	20 12·8

BOMBAY

MAGNETICAL AND METEOROLOGICAL OBSERVATIONS,

1888 AND 1889.

Appendices I and II.

I.—History of the set of Magnetographs established at the Cola'ba Observatory, Bombay [*continued*].

II.—The Solar Diurnal Variations of Declination, Horizontal Force, and Vertical Force at Bombay, as derived from the Registrations of the Cola'ba Magnetographs [*continued*].

By

CHARLES CHAMBERS, F.R.S.,

Director of the Cola'ba Observatory, Bombay.

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CONTENTS OF APPENDICES.

APPENDIX I.

HISTORY OF THE SET OF MAGNETOGRAPHS ESTABLISHED AT THE COLÁBA OBSERVATORY, BOMBAY.

	Paragraph.
In continuation of Appendix I of the Bombay Magnetical and Meteorological Observations, 1879—82, and told by reference thereto—paragraph by paragraph ...	1
Measured true direction of axis of telescope of horizontal force magnetograph ...	3
Limits of dip of axis of vertical force magnet	6
Tables of deflection observations made upon the magnet N 3 and upon the vertical force magnetograph	7
Fuller statement of the theory of the deflection observations in the horizontal plane ..	8 & 9
Mode of calculating p from one large deflection observation and several small deflection observations combined	10
Data for calculation of p and results. Table 4	11
Evidence that the method of determining p is an improvement upon the former method	12
Data for calculation of J and results. Table 5	13
Further evidence of improvement in the method of determining p, in that it leads to consistent values of J	14
Data used for calculation of Y by means of equation (8). Tables 6 and 7. Results given in Table 10	15
Values of $\frac{\cdot 46108}{12} Wg \times (w\,o)$ for integral scale-divisions between 23 and 44. Table 8	16
Calculation of the magnetic moment of the vertical force magnet for each year from 1879 to 1891	17
Values of $\frac{Wg}{m} (w\,o)$ for each scale reading of the deflection experiments made upon the vertical force magnetograph. Table 10	18
Order of observation in the deflection experiments	19
Do. do. , modification of	20
Vibration of vertical force magnet kept within narrow limits during deflections of it, and final reading taken only after intervals of 10 or 5 minutes	21
Calculation from data of Table 10 of the $\frac{dy}{ds}$, of each experiment, applicable to the scale reading 33·2. Table 11	22
Straight lines representing, for the several experiments, the variation of disturbing force with variation of scale reading, or $\frac{dy}{ds}$ for the scale reading 33·2. Figures 1 to 11 of Plate I	23
Suggestions in explanation of the deviations of some of the points representing individual deflections from the general course of the straight lines	...24 to 26
Calculation of probable error of scale-coefficient yielded by a set of experimental deflections	27
The probable error is—within the limits of trial—relatively greater the more sensitive the instrument is made	28
Monthly deflections made upon the vertical force magnetograph, and scale-coefficients derived from them. Table 12	29
Division of monthly deflections into groups	30
List of changes made in the adjustments	30*a*
Calculation, for each group, of the coefficients A, b and c of the expression $A+b(t-80)+c\,T$ of the value of the scale-coefficient. Table 13	31
Explanation of irregularities in the value of the coefficient b	32
Criterion for fixing the degree of sensitiveness to which the instrument should be adjusted	33
Comparison of scale-coefficients yielded by the large deflection experiments with those yielded by the monthly deflections. Table 14	34

Paragraph.

The latter found to be systematically greater than the former :—explanation ... 35

Equal weight given to the two methods of determining the scale-coefficient in fixing the value to be adopted of the constant A ... ... id.

Adopted values of the constants A, b and c for unbroken periods of observation—collected together 36

Calculations of monthly values of $\frac{dy}{ds}$. Table 16 37

Indications of vacuum gauge at the beginning and end of periods during which the air in the enclosure of the vertical force magnetograph was under artificial pressure 38

TEMPERATURE-COEFFICIENT OF THE VERTICAL FORCE MAGNETOGRAPH 39

SCALE-COEFFICIENT OF THE HORIZONTAL FORCE MAGNETOGRAPH.

Deflection experiments made upon the magnet N 3. Tables 17 and 18... ... 40

Do. do. horizontal force magnetograph. Tables 19 and 20 id.

Value of the ratio $\frac{d'}{d}$. Table 21—Experiments XII to XVIII 41

Deduced values of p. Adopted value=0 42

Values of $\frac{a'}{a} \frac{2}{2} \frac{d'}{d}$ or $\frac{1}{dv} \frac{dX}{X}$. Table 22—Experiments XIII to XVIII 43

Calculations of p from one large deflection and several small deflections combined. Table 23—Experiments XIX to XXII 44

Investigations of paragraphs 8 and 9 modified to suit the case when the deflector is end-on to the deflected magnet. Values of Y, J and $\frac{1}{dv} \frac{dX}{X}$ 45

Data for the calculation of J, and results. Table 24—Experiments XIX to XXII... 46

Data for the calculation of $\frac{1}{dv} \frac{dX}{X}$, and results. Table 25—Experiments XIX to XXII 47

Inclination of axis of magnet to magnetic meridian : scale reading corresponding to inclination of 90°, and changes thereof ... ...48 to 52

Adulteration of record by variations of declination when inclination differs from 90° 53

List of changes made in the adjustments 54

Division of experiments into groups and calculation for each group of $\frac{1}{dv} \frac{dX_o}{X_o}$. Table 26 55

Exactness in the value of S chosen not important 56

Probable errors of adopted values of $\frac{1}{dv} \frac{dX_o}{X_o}$ 57

Calculation of monthly values of the scale-coefficient from July 1882 to April 1889. Table 27 58

Air in enclosure of instrument has been of natural atmospheric pressure since May 24, 1880 ... ... id.

TEMPERATURE COEFFICIENT OF THE HORIZONTAL FORCE MAGNETOGRAPH ... ... id.

DECLINATION MAGNETOGRAPH.

Air in enclosure of instrument has been under artificial pressure—between 2·28 and 2·22 inches of mercury—since July 18, 1876 59

Names of observers, and initials used by them 60

APPENDIX II.

THE SOLAR DIURNAL VARIATIONS OF DECLINATION, HORIZONTAL FORCE AND VERTICAL FORCE AT BOMBAY, AS DERIVED FROM THE REGISTRATIONS OF THE COLÁBA MAGNETOGRAPHS [*continued*].

In continuation of Appendix IV of the Bombay Magnetical and Meteorological Observations, 1879—82 61

Data (entries on monthly abstracts) and mode of treatment. Tables 28 to 56 ... id.

Correction of variations for progressive change of scale reading 62

Exhibition of general character of diurnal variations. Figs. 375 to 377 ... 63

Change from month to month in the ranges of mean diurnal variations—Table 57, and remarks thereon 64

Change from year to year in the ranges of mean diurnal variations—Table 58, and remarks thereon 65

	Paragraph.
Elimination of annual variation of ranges—selection of material for	66
Absolute ranges. Tables 59 to 61	67
Ranges of horizontal force after elimination of annual variation, and ranges from earlier maximum to next following minimum of declination and vertical force after elimination of annual variation. Tables 62 to 64	68
The sun-spot period in the curves of declination and horizontal force ranges ...	69
Parallelism of movement of declination and vertical force ranges	id.
Period of $3\frac{2}{3}$ years in the variations of range. Table 65	70
Do. do. after elimination of progressive change. Table 66	71
Curves of variation of range in period of $3\frac{2}{3}$ years expand and contract in a period of $14\frac{2}{3}$ years	72
Secular variation of ranges after elimination of sun-spot period. Tables 67 to 69. Most remarkable feature is the increase of horizontal force range from 1853 to 1861...	73
Mean readings of thermometers enclosed with the horizontal force and vertical force magnetographs, and diurnal range in each month of the year. Table 70 ...	74
Diurnal range of temperature negligible in the case of the horizontal force magnetograph and small in the case of the vertical force magnetograph	75
Inequalities of temperature for each hour in each year	id.
Rules observed in the treatment of imperfect magnetograms	76
Calculation of diurnal variation for a month of broken periods	77
Calculations carried to how many places of decimals	78
Statement of irregularities of procedure	79
With regard to declination magnetograms...	... 80, 81
do. horizontal force do.	...82—85
do. vertical force do.	...86—91

DESCRIPTION OF PLATES.

	Plate.	Figure.	Page.
Colába Vertical Force Magnetograph—scale-coefficients ...	I	1 to 12	To face [16]
Declination Magnetograph—Diurnal variation for single months from May 1882 to December 1888	II	13 to 92	Back of plate to [48] and [49]
Horizontal Force Magnetograph—Diurnal variation for single months from May 1880 to December 1888 ...	III	93 to 196	Do. to [56] and [57]
Vertical Force Magnetograph—Diurnal variation for single months from May 1879 to December 1888	IV	197 to 312	Do. to [66] and [67]
Declination, Horizontal Force and Vertical Force Magnetographs—Mean diurnal variation for each month ...	V	313 to 348	Back of plate to [70]
Declination, Horizontal Force and Vertical Force Magnetographs—Mean diurnal variation for each year and for combinations of years	VI	349 to 377	Do. do. [71]
Secular variations of the diurnal range of Declination, Horizontal Force and Vertical Force: also variation in period of $3\frac{2}{3}$ years	VII	378 to 397	To face [72]

APPENDIX I.

History of the set of Magnetographs established at the Cola'ba Observatory, Bombay.

[Continued from Appendix I, pages [1] to [83], of the Bombay Magnetical and Meteorological Observations, 1879—82.]

The history to be now related, being in continuation of that which appeared in Appendix I to the "Bombay Magnetical and Meteorological Observations, 1879—82", will be arranged in the same manner as that was, and the better to indicate the continuity of the whole, the several paragraphs of the Appendix will be noted in order and new matter be introduced in the place appropriate to its subject amongst the paragraphs: the reader will be enabled, by referring to the noted paragraphs of the Appendix, to connect together the earlier and the later histories, and thus to obtain a concise view of all that has to be told on any particular point, and this without our reprinting in full what has already been published in the Appendix I of 1879—82.

Appendix I, 1879—82, paragraphs 1 to 4.

2. Appendix I, 1879—82, paragraph 5. Since the 14th February 1884 the fire is lighted in the stove at the foot of the tall copper chimney, not daily, but only occasionally to fit the room for prolonged occupation when fresh adjustments of the instruments or other lengthy experiments have to be made.

3. In October 1882 the true direction of the axis of the telescope of the horizontal force magnetograph was measured and found to be N. 88° 38′ W.: this was done by stretching lines over a drawing board held firmly on a horizontal table—one line above and parallel to the axis of the telescope and the other between vertical pencil lines marked on the north and south walls of the room—and by then drawing pencil lines on the board coincident with the stretched lines: the angle between the pencil lines on the board was measured by a protractor and found to be 74° 34′, which being added to 14° 4′, the true azimuth of the vertical plane containing the lines on the wall, gives N. 88° 38′ W. as the approximate true direction of the axis of the telescope. The vertical lines were marked on the wall with reference to the ivory scales fixed thereto (see Appendix I, 1879—82, paragraph 6) and the known direction N. 14° 15′ 2″ W.; so that the horizontal line joining them should have the direction N. 14° 4′ W. The vertical plane through the line stretched over the telescope was estimated to cut the division of the scale 24·7, and on a later occasion the plane containing the vertical bisecting lines of the object glass and eye-piece was estimated to cut the division 25·15. The scale division 25·00, as being nearly equal to the mean of the two estimates, has been adopted as the division cut by the vertical plane passing through the axis of the telescope..

Appendix I, 1879—82, paragraphs 6 to 13.

4. Appendix I, 1879—82, paragraph 14. The scales of the three instruments, as well as the thermometers of the two force instruments have been read five times a day, as follows:—

from 1873·0 onward..... about the civil hours 6, 10, 14, 16 and 22, the minute of reading having always been .

for the declination	18 after the hour
for the horizontal force magnetograph	19 after the hour
and for the vertical force magnetograph	17 after the hour

The vacuum gauges of the declination and vertical force magnetographs have been read once a day at 10 hours.

Appendix I, 1879—82, paragraph 15.

5. Appendix I, 1879—82, paragraph 16. Since November 1882 the average time occupied in changing the papers has been about 6 minutes and that occupied in shifting the cylinders only about 2 minutes.

Appendix I, 1879—82, paragraph 17.

SCALE COEFFICIENT OF THE VERTICAL FORCE MAGNETOGRAPH.

Appendix I, 1879—82, paragraphs 18 to 21.

6. Appendix I, 1879—82, paragraph 22. During the period July 1882 to April 1889, the mean monthly scale-readings of the vertical force magnetograph all lay between 27·00 and 38·00.

Appendix I, 1879—82, paragraphs 23 to 26.

7. Appendix I, 1879—82, paragraph 27. The following tables (1 to 3) will be understood without any further description of them than their headings and the notes to them afford:—

TABLE 1.—*Experimental deflections of the Magnet N 3, suspended in the Electrometer Tower, by the deflector Magnet E 1.*

OBSERVATIONS.

[Corresponding to Table 2 of Appendix I, 1879—82.]

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
XVII.—14th April 1883.	14 19 11	13·95	89·1	Away.	...	P.
	„ „ 15	13·43	...	3·0 S.	E.	
	„ „ 18	14·49	...	3·0 S.	W.	
	„ „ 21	13·96	...	Away.	...	
	„ „ 24	14·50	...	3·0 N.	W.	
	„ „ 27	13·42	...	3·0 N.	E.	
	„ „ 30	13·96	89·2	Away.	...	
	„ „ 33	13·05	...	2·5 N.	E.	
	„ „ 35	14·97	...	2·5 N.	W.	
	„ „ 38	13·97	...	Away.	...	
	„ „ 41	14·95	...	2·5 S.	W.	
	„ „ 44	13·04	...	2·5 S.	E.	
	„ „ 47	13·98	89·4	Away.	...	
	„ „ 50	12·81	...	2·3 S.	E.	
	„ „ 53	15·21	...	2·3 S.	W.	
	„ „ 56	13·99	...	Away.	...	
	„ „ 59	15·19	...	2·3 N.	W.	
	„ 20 2	12·80	...	2 3 N.	E.	
	„ „ 6	13·99	89·6	Away.	...	
	„ „ 9	12·17	...	2·0 N.	E.	
	„ „ 12	15·92	...	2·0 N.	W.	
	„ „ 15	13·99	...	Away.	...	
	„ „ 18	15·93	...	2·0 S.	W.	
	„ „ 21	12·15	...	2·0 S.	E.	
	„ „ 24	13·98	89·7	Away.	...	
	„ „ 27	11 36	...	1·8 S.	E.	
	„ „ 30	16·56	...	1·8 S.	W.	
	„ „ 33	13·99	...	Away.	...	
	„ „ 36	16·52	...	1·8 N.	W.	
	„ „ 39	11·40	...	1·8 N.	E.	
	„ „ 42	13·98	89·8	Away.	...	
	„ „ 48	1·04	...	1·08 N.	E.	
	„ „ 52	26·85	...	1·08 N.	W.	
	„ „ 55	13·99	...	Away.	...	
	„ „ 59	26·93	...	1·08 S.	W.	
	„ 21 4	0·95	...	1·08 S.	E.	
	„ „ 8	13·97	89·8	Away.	...	
XVIII.—30th January 1884.	30 21 14	14·11	76·2	Away.	...	P. and D.
	„ „ 18	13·57	...	3·0 S.	E.	
	„ „ 21	14·68	...	3·0 S.	W.	
	„ „ 25	14·11	...	Away.	...	
	„ „ 29	14·65	...	3·0 N.	W.	
	„ „ 33	13·59	...	3·0 N.	E.	
	„ „ 39	14·13	76·1	Away.	...	
	„ „ 43	13·47	...	2·8 N.	E.	
	„ „ 47	14·77	...	2·8 N.	W.	
	„ „ 51	14·13	...	Away.	...	
	„ „ 55	14·77	...	2·8 S.	W.	
	„ „ 59	13·47	...	2·8 S.	E.	
	„ 22 5	14·12	76·1	Away.	...	
	„ „ 9	13·40	...	2·7 S.	E.	
	„ „ 13	14·85	...	2·7 S.	W.	
	„ „ 17	14·11	...	Away.	...	
	„ „ 20	14·87	...	2·7 N.	W.	
	„ „ 24	13·42	...	2·7 N.	E.	
	„ „ 29	14·11	76·0	Away.	...	
	„ „ 33	13·35	...	2·6 N.	E.	

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
XIX.—7th March 1885.	30 22 37	14·95	...	2·6 N.	W.	P. and D.
	„ „ 41	14·13	...	Away.	...	
	„ „ 44	14·94	...	2 6 S.	W.	
	„ „ 48	13 32	...	2·6 S.	E.	
	„ „ 53	14·12	75·9	Away.	...	
	„ „ 56	13·20	...	2·5 S.	E.	
	„ „ 59	15·05	...	2·5 S.	W.	
	„ 23 3	14·13	...	Away.	...	
	„ „ 7	15·02	...	2·5 N.	W.	
	„ „ 11	13·21	...	2·5 N.	E.	
	„ „ 16	14·13	75·8	Away.	...	
	„ „ 19	1·26	...	1·08 N.	E.	
	„ „ 24	26·96	...	1·08 N.	W.	
	„ „ 29	14·17	...	Away.	...	
	„ „ 34	27·21	...	1·08 S.	W.	
	„ „ 39	0·95	...	1·08 S	E.	
	„ „ 44	14·12	75·5	Away.	...	
	7 19 5	13·92	81·5	Away.	...	P. and G. S. J.
	„ „ 8	13·39	...	3·0 S.	E.	
	„ „ 12	14·43	...	3·0 S.	W.	
	„ „ 16	13·92	...	Away.	...	
	„ „ 19	14·43	...	3·0 N.	W.	
	„ „ 22	13·40	...	3·0 N.	E.	
	„ „ 27	13·91	81·6	Away.	...	
	„ „ 31	13·01	...	2·5 N.	E.	
	„ „ 36	14·84	...	2·5 N.	W.	
	„ „ 40	13·93	...	Away.	...	
	„ „ 44	14·85	...	2·5 S.	W.	
	„ „ 48	13·00	...	2·5 S.	E.	
	„ „ 53	13·92	81·3	Away.	...	
	„ „ 57	12·73	...	2·3 S.	E.	
	„ 20 1	15·15	...	2 3 S.	W.	
	„ „ 5	13·92	...	Away.	...	
	„ „ 9	15·13	...	2·3 N.	W.	
	„ „ 14	12·75	...	2·3 N.	E.	
	„ „ 19	13·93	81·2	Away.	..	
	„ „ 24	12·18	...	2·0 N.	E.	
	„ „ 28	15·72		2·0 N.	W.	
	„ „ 32	13·93	...	Away.	...	
	„ „ 36	15·74	...	2 0 S.	W.	
	„ „ 40	12·16	...	2·0 S.	E.	
	„ „ 45	13·91	81·0	Away.	...	
	„ „ 50	11·37	...	1·8 S.	E.	
	„ „ 53	16·50	...	1·8 S.	W.	
	„ „ 56	13·91	...	Away.		
	„ 21 0	16·42	...	1·8 N.	W.	
	„ „ 4	11·47	...	1·8 N.	E.	
	„ „ 9	13·94	80·9	Away.	...	
	„ „ 15	1·58	...	1·08 N.	E.	
	„ „ 19	26·35	...	1·08 N.	W.	
	„ „ 23	13·91	...	Away.	...	
	„ „ 27	27·15	...	1·08 S.	W.	
	„ „ 33	0·53	...	1·08 S.	E.	
	„ „ 38	13·90	80·7	Away.	...	

TABLE 1—*continued.*

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
XX.—28th—29th January 1886.	28 21 46	13·82	78·1	Away.	...	V. N. and P.
	,, ,, 55	13·26	...	3·0 S.	E.	
	,, ,, 58	14·34	...	3·0 S.	W.	
	,, 22 2	13 80	...	Away.	...	
	,, ,, 5	14·34	...	3·0 N.	W.	
	,, ,, 8	13·28	...	3·0 N.	E.	
	,, ,, 11	13 81	76·9	Away.	...	
	,, ,, 15	12·91	...	2·5 N.	E.	
	,, ,, 18	14·73	...	2·5 N.	W.	
	,, ,, 21	13·83	...	Away.	...	
	,, ,, 25	14·77	...	2·5 S	W.	
	,, ,, 29	12·89	...	2·5 S.	E.	
	,, ,, 32	13·83	76·8	Away.	...	
	,, ,, 36	12·61	...	2·3 S.	E.	
	,, ,, 40	15·05	...	2 3 S.	W.	
	,, ,, 43	14·83	...	Away.	...	
	,, ,, 46	15·01	...	2·3 N.	W.	
	,, ,, 50	12·67	...	2·3 N.	E.	
	,, ,, 54	13·83	76·3	Away.	...	
	,, ,, 58	12·03	...	2·0 N.	E.	
	,, 23 1	15·63	..	2·0 N.	W.	
	,, ,, 5	13·85	...	Away.	...	
	,, ,, 9	15·71	...	2·0 S.	W.	
	,, ,, 13	12·00	...	2·0 S.	E.	
	,, ,, 18	13·85	75·9	Away.	...	
	,, ,, 22	11·29	...	1·8 S.	E.	
	,, ,, 26	16·45	...	1·8 S.	W.	
	,, ,, 30	13·85	...	Away.	...	
	,, ,, 34	16·32	...	1·8 N.	W.	
	,, ,, 38	11·44	...	1·8 N.	E.	
	,, ,, 42	13·85	75·7	Away.	..	
	,, ,, 47	1·60	...	1·08 N.	E.	
	,, ,, 52	26·12	...	1·08 N.	W.	
	,, ,, 56	13·84	...	Away.	...	
	29 0 2	27·23	...	1·08 S.	W.	
	,, ,, 8	0·29	...	1·08 S.	E.	
	,, ,, 14	13·82	75·7	Away.	...	
XXI.—19th—20th February 1886.	19 21 5	14·48	79·8	Away.	...	V. N. and P.
	,, ,, 8	13·95	...	3·0 S.	E.	
	,, ,, 11	15·03	...	3·0 S.	W.	
	,, ,, 14	14·49	...	Away.	...	
	,, ,, 17	15·02	...	3·0 N.	W.	
	,, ,, 20	13·97	...	3·0 N.	E.	
	,, ,, 25	14·49	79 8	Away.	...	
	,, ,, 29	13·56	...	2·5 N.	E.	
	,, ,, 33	15·41	...	2·5 N.	W.	
	,, ,, 36	14·48	...	Away.	...	
	,, ,, 39	15·42	...	2·5 S.	W.	
	,, ,, 42	13·55	...	2·5 S.	E.	
	,, ,, 47	14·49	79·7	Away.	..	
	,, ,, 50	13·29	...	2·3 S.	E.	
	,, ,, 53	15·72	...	2·3 S.	W.	
	,, ,, 57	14·51	...	Away.	...	
	,, 22 1	15·69	...	2·3 N.	W.	
	,, ,, 5	13·35	...	2·3 N.	E.	
	,, ,, 10	14·51	79·7	Away.	...	
	,, ,, 14	12·73	...	2·0 N.	E.	
	,, ,, 18	16·31	...	2·0 N.	W.	
	,, ,, 22	14·53	...	Away.	...	
	,, ,, 26	16·38	...	2·0 S.	W.	
	,, ,, 30	12·65	...	2·0 S.	E.	

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
	19 22 35	14·53	79·6	Away.	...	V. N. and P.
	,, ,, 41	12·05	...	1·8 S.	E.	
	,, ,, 47	17·12	...	1·8 S.	W.	
	,, ,, 52	14·53	...	Away.	...	
	,, ,, 58	17·01	...	1·8 N.	W.	
	,, 23 4	12·14	...	1·8 N.	E.	
	,, ,, 39	14·55	79·6	Away.	...	
	,, ,, 44	2·25	...	1·08 N.	E.	
	,, ,, 51	27·05	...	1·08 N.	W.	
	,, ,, 54	14·65	...	Away.	...	
	20 0 0	27·99	...	1·08 S.	W.	
	,, ,, 6	1·40	...	1·08 S.	E.	
	,, ,, 12	14·66	79·8	Away.	...	
XXII.—28th January 1887.	28 20 40	14·20	77·9	Away.	...	P. and V. G. G.
	,, ,, 43	13·66	...	3·0 S.	E.	
	,, ,, 46	14·73	...	3·0 S.	W.	
	,, ,, 49	14·20	...	Away.	...	
	,, ,, 53	14·73	...	3·0 N.	W.	
	,, ,, 57	13·67	...	3·0 N.	E.	
	,, 21 2	14·20	78·0	Away.	...	
	,, ,, 6	13·28	...	2·5 N.	E.	
	,, ,, 9	15·11	...	2·5 N.	W.	
	,, ,, 12	14·20	...	Away.	...	
	,, ,, 15	15·11	...	2·5 S.	W.	
	,, ,, 17	13·27	...	2·5 S.	E.	
	,, ,, 21	14·19	78·0	Away.	...	
	,, ,, 24	13·02	...	2·3 S.	E.	
	,, ,, 27	15·39	...	2·3 S.	W.	
	,, ,, 30	14·21	...	Away.	...	
	,, ,, 33	15·38	...	2·3 N.	W.	
	,, ,, 36	13·01		2·3 N.	E.	
	,, ,, 40	14·20	77·9	Away.	...	
	,, ,, 44	12·44	...	2·0 N.	E.	
	,, ,, 47	16·00	...	2·0 N.	W.	
	,, ,, 50	14·20	...	Away.	...	
	,, ,, 53	16·02	...	2·0 S.	W.	
	,, ,, 56	12·43	...	2·0 S.	E.	
	,, ,, 59	14·20	77·8	Away.	...	
	,, 22 3	11·73	...	1·8 S.	E.	
	,, ,, 6	16·75	...	1·8 S.	W.	
	,, ,, 9	14·20	..	Away.	...	
	,, ,, 12	16·72	...	1·8 N.	W.	
	,, ,, 15	11·74	...	1 8 N.	E.	
	,, ,, 20	14·21	77·6	Away.	...	
	,, ,, 24	1·53	...	1·08 N.	E.	
	,, ,, 29	26·87	...	1·08 N.	W.	
	,, ,, 33	14·21	...	Away.	...	
	,, ,, 37	27·14	...	1·08 S.	W.	
	,, ,, 42	1·34	...	1·08 S.	E.	
	,, ,, 48	14·21	77·6	Away.	...	
	5 20 33	14·17	76·3	Away.	...	P. and D.
	,, ,, 37	13·62	...	3·0 S.	E.	
	,, ,, 40	14·70	...	3·0 S.	W.	
	,, ,, 43	14·16	...	Away.	...	
	,, ,, 46	14·69	...	3·0 N.	W.	
	,, ,, 49	13·62	...	3·0 N.	E.	
	,, ,, 54	14·16	76·3	Away.	...	
	,, ,, 58	13·21	...	2·5 N.	E.	
	,, 21 2	15·08	...	2·5 N.	W.	

TABLE 1—*continued.*

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
XXIII.—5th February 1887.	5 21 5	14·15	...	Away.	...	P. and D.
	,, ,, 9	15·10	...	2·5 S.	W.	
	,, ,, 13	13·23	...	2·5 S.	E.	
	,, ,, 17	14·14	76·2	Away.	...	
	,, ,, 21	12·99	...	2·3 S.	E.	
	,, ,, 25	15·37	...	2·3 S.	W.	
	,, ,, 29	14·17	...	Away.	...	
	,, ,, 32	13·02	...	2·3 N.	E.	
	,, ,, 35	15·36	....	2·3 N.	W.	
	,, ,, 38	14·17	76·2	Away.	...	
	,, ,, 41	15·99	....	2·0 N.	E.	
	,, ,, 44	12·44	...	2·0 N.	W.	
	,, ,, 47	14·18	...	Away.	...	
	,, ,, 50	12·40	...	2·0 S.	W.	
	,, ,, 53	16·02	...	2·0 S.	E.	
	,, ,, 57	14·20	76·3	Away.	...	
	,, 22 0	16·74	...	1·8 S.	E.	
	,, ,, 3	11·65	...	1·8 S.	W.	
	,, ,, 6	14·18	...	Away.	...	
	,, ,, 9	11·70	...	1·8 N.	W.	
	,, ,, 12	16·66	...	1·8 N.	E.	
	,, ,, 17	14·17	76·4	Away.	...	
	,, ,, 22	26·67	...	1·08 N.	E.	
	,, ,, 26	1·57	...	1·08 N.	W.	
	,, ,, 31	14·19	...	Away.	...	
	,, ,, 35	1·11	...	1·08 S.	W.	
	,, ,, 40	27·34	...	1·08 S.	E.	
	,, ,, 45	14·18	76·5	Away.	...	
XXIV.—19th May 1888.	19 20 27	14·07	91·8	Away.	...	V. N. and V. G. G.
	,, ,, 37	13·58	...	3·0 S.	E.	
	,, ,, 41	14·60	...	3·0 S.	W.	
	,, ,, 44	14·08	...	Away.	...	
	,, ,, 48	14·61	...	3·0 N.	W.	
	,, ,, 51	13·56	...	3·0 N.	E.	
	,, ,, 54	14·10	91·6	Away.	...	
	,, ,, 57	13·19	...	2·5 N.	E.	
	,, ,, 59	14·99	...	2·5 N.	W.	
	,, 21 1	14·08	...	Away.	...	
	,, ,, 3	15·02	...	2·5 S.	W.	
	,, ,, 6	13·18	...	2·5 S.	E.	
	,, ,, 9	14·10	91·4	Away.	...	
	,, ,, 12	12·93	...	2·3 S.	E.	
	,, ,, 17	15·26	...	2·3 S.	W.	
	,, ,, 20	14·10	...	Away.	...	
	,, ,, 23	15·27	...	2·3 N.	W.	
	,, ,, 27	12·93	...	2·3 N.	E.	
	,, ,, 30	14·10	91·1	Away	...	
	,, ,, 42	12·33	...	2·0 N.	E.	
	,, ,, 49	15·89	...	2·0 N.	W.	
	,, ,, 52	14·10	...	Away.	...	
	,, ,, 54	15·89	...	2·0 S.	W.	
	,, ,, 56	12·35	..	2·0 S.	E.	

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
XXV.—9th May 1889.	19 22 0	14·11	90·9	Away.	...	V. N. and V. G. G.
	,, ,, 4	11·64	...	1·8 S.	E.	
	,, ,, 8	16·67	...	1·8 S.	W.	
	,, ,, 12	14·11	...	Away.	...	
	,, ,, 14	16·59	...	1·8 N.	W.	
	,, ,, 16	11·65	...	1·8 N.	E.	
	,, ,, 18	14·13	90·8	Away.	...	
	,, ,, 20	1·43	...	1·08 N.	E.	
	,, ,, 23	26·69	...	1·08 N.	W.	
	,, ,, 28	14·11	...	Away.	...	
	,, ,, 31	26·76	...	1·08 S.	W.	
	,, ,, 37	1·42	..	1·08 S.	E.	
	,, ,, 43	14·10	90·5	Away.	...	
	9 21 5	13·89	91·3	Away.	...	V. N. and V. G. G.
	,, ,, 14	13·37	...	3·0 S.	E.	
	,, ,, 17	14·42	...	3·0 S.	W.	
	,, ,, 19	13·89	...	Away.	...	
	,, ,, 22	14·43	...	3·0 N.	W.	
	,, ,, 25	13·36	...	3·0 N.	E.	
	,, ,, 28	13·89	90·8	Away.	...	
	,, ,, 30	12·98	...	2·5 N.	E.	
	,, ,, 32	14·80	...	2·5 N.	W.	
	,, ,, 35	13·89	...	Away.	...	
	,, ,, 38	14·80	...	2·5 S.	W.	
	,, ,, 41	12·97	...	2·5 S.	E.	
	,, ,, 44	13·89	90·7	Away.	...	
	,, ,, 49	12·72	...	2·3 S.	E.	
	,, ,, 52	15·09	...	2·3 S.	W.	
	,, ,, 55	13·89	...	Away.	...	
	,, ,, 59	15·07	...	2·3 N.	W.	
	,, 22 2	12·72	...	2·3 N.	E.	
	,, ,, 10	13·89	90·6	Away.	...	
	,, ,, 15	12·15	...	2·0 N.	E.	
	,, ,, 19	15·69	...	2·0 N.	W.	
	,, ,, 21	13·90	...	Away.	...	
	,, ,, 23	15·70	...	2·0 S.	W.	
	,, ,, 27	12·15	...	2·0 S.	E.	
	,, ,, 32	13·89	90·6	Away.	...	
	,, ,, 35	11·44	...	1·8 S.	E.	
	,, ,, 38	16·40	...	1·8 S.	W.	
	,, ,, 42	13·90	...	Away.	...	
	,, ,, 45	16·38	...	1·8 N.	W.	
	,, ,, 48	11·44	...	1·8 N.	E.	
	,, ,, 53	13·90	90·6	Away.	...	
	,, 23 2	1·31	..	1·08 N.	E.	
	,, ,, 6	26·40	...	1·08 N.	W.	
	,, ,, 10	13·89	....	Away.	...	
	,, ,, 15	26·57	...	1·08 S.	W.	
	,, ,, 20	1·26	...	1·08 S.	E	
	,, ,, 23	13·90	90·6	Away.	...	

TABLE 2.—*Experimental deflections of the Magnet N 3, suspended in the Electrometer Tower, by the deflector Magnet E 1.*

CALCULATION, FROM THE DATA IN TABLE 1, OF THE DOUBLE DEFLECTIONS.

[Corresponding to Table 3 of Appendix I, 1879—82.]

Number of Experiment.	Distance.	Means. Higher reading.	Means. Lower reading.	Difference or double deflection.	Double deflection. Corrected for crack in the scale.*	Torsion coefficient.	Value of one division of scale.†	Deflection of Magnet N°3 c by Magnet E 1 at 1·0 foot distance.‡
XVII. 14th April 1883.	3·0	14·49	13·42	1·07	...	1·00101	14′·30	6°50′22″
	2·5	14·96	13·04	1·92	...	...	...	...
	2·3	15·20	12·80	2·40	...	...	..	...
	2·0	15·92	12·16	3·76	3·79	...	...	...
	1·8	16·54	11·38	5·16	5·19	...	...	...
	1·08	26·89	0·99	25·90	25·93	...	...	...
XVIII. 30th January 1884.	3·0	14·66	13·58	1·08	...	1·00143	14′·30	6°48′15″
	2·8	14·77	13·47	1·30	...	...	...	...
	2·7	14·86	13·41	1·45	...	...	...	...
	2·6	14·94	13·33	1·61	...	...	...	...
	2·5	15·03	13·20	1·83	...	...	...	...
	1·08	27·08	1·10	25·98	26·01	...	...	...
XIX. 7th March 1885.	3·0	14·43	13·39	1·04	...	1·00194	14′·31	6°46′42″
	2·5	14·84	13·00	1·84	...	...	...	...
	2·3	15·14	12·74	2·40	...	...	...	...
	2·0	15·73	12·17	3·56	3·59	...	...	...
	1·8	16·46	11·42	5·04	5·07	...	...	...
	1·08	26·75	1·05	25·70	25·73	...	...	...
XX. 28th—29th January 1886.	3·0	14·34	13·27	1·07	...	1·00135	14′·30	6°43′57″
	2·5	14·75	12·90	1·85	...	..	...	...
	2·3	15·03	12·64	2·39	...	...	...	...
	2·0	15·67	12·01	3·66	3·72	...	...	...
	1·8	16·38	11·36	5·02	5·08	...	...	...
	1·08	26·67	0·94	25·73	25·79	...	...	...
XXI. 19th—20th February 1886.	3·0	15·02	13·96	1·06	...	1·00127	14′·30	6°43′55″
	2·5	15·41	13·55	1·86	...	...	...	...
	2·3	15·70	13·32	2·38	...	...	...	...
	2·0	16·34	12·69	3·65	...	...	...	...
	1·8	17·06	12·09	4·97	5·04	...	...	...
	1·08	27·52	1·82	25·70	25·77	...	...	...
XXII. 28th January 1887	3·0	14·73	13·66	1·07	...	1·00146	14′·30	6°42′7″
	2·5	15·11	13·27	1·84	...	...	...	...
	2·3	15·38	13·01	2·37	...	...	...	...
	2·0	16·01	12·43	3·58	3·65	...	...	...
	1·8	16·73	11·73	5·00	5·07	...	...	...
	1·08	27·00	1·43	25·57	25·64	...	...	...
XXIII. 5th February 1887.	3·0	14·69	13·62	1·07	...	1·00141	14′·30	6°42′7″
	2·5	15·09	13·22	1·87	...	...	...	...
	2·3	15·36	13·00	2·36	...	...	...	...
	2·0	16·00	12·42	3·58	3·64	...	...	...
	1·8	16·70	11·67	5·03	5·09	...	...	...
	1·08	27·00	1·34	25·66	25·72	...	...	—
XXIV. 19th May 1888.	3·0	14·60	13·57	1·03	...	1·00119	14′·30	6°38′2″
	2·5	15·00	13·18	1·82	...	...	...	...
	2·3	15·26	12·93	2·33	...	...	...	..
	2·0	15·89	12·34	3·55	3·61	...	...	...
	1·8	16·63	11·64	4·99	5·05	...	...	..
	1·08	26·72	1·42	25·30	25·36	...	...	...
XXV. 9th May 1889.	3·0	14·42	13·36	1·06	...	1·00159	14′·30	6°37′32″
	2·5	14·80	12·97	1·83	...	...	...	...
	2·3	15·08	12·72	2·36	...	...	...	...
	2·0	15·69	12·15	3·54	3·61	...	...	...
	1·8	16·39	11·44	4·95	5·02	..	...	..
	1·08	26·48	1·28	25·20	25·27	...	—	...

* The ivory scale is cracked between the divisions 12·5 and 13·0: at first the crack gaped to the extent of ·03 division, but has now grown (in May 1889) to ·07 division.

† This depends on the distance of the mirror attached to the suspended magnet from the scale, a distance which is not, in all the sets of experiments, exactly the same.

‡ These observations are taken to remove any doubt about the practical constancy of strength of the deflector Magnet E 1. As the horizontal force changes but slightly, the magnetic moment of E 1 is nearly proportional to the sines of these angles, or roughly to the angles themselves. Magnet N °3 c is the suspended magnet, in the deflection experiment, of the Unifilar Magnetometer by Elliott Brothers, used for the regular determination of absolute horizontal force.

TABLE 3.—*Experimental deflections of the Vertical Force Magnetograph by the deflector Magnet E 1.*

[Corresponding to Table 4 of Appendix I, 1879—82.]

Number and date of Experiment.	Local Time by Magnetograph Clock.	Vertical Force Magnetograph. — Scale reading.	Thermometer.	Vacuum Gauge.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.						
XVII *a*.—13th April 1883.	13 19 14	27·80	88·0	2·31	Away.	...	P.
	„ „ 27	25·60	...	...	3·0 N.	Down.	
	„ „ 35	29·43	...	...	3·0 N.	Up.	
	„ „ 45	30·72	...	...	2·5 N.	Up.	
	„ „ 54	31·51	...	...	2·3 N.	Up.	
	„ 20 5	33·66	...	...	2·0 N.	Up.	
	„ „ 13	36·25	...	...	1·8 N.	Up.	
	„ „ 23	28·32	88·4	2·32	Away.	...	
	„ „ 34	25·58	...	...	3·0 S.	Down.	
	„ „ 43	29·51	...	...	3·0 S.	Up.	
	„ „ 54	30·80	...	...	2·5 S.	Up.	
	„ 21 4	31·60	...	...	2·3 S.	Up.	
	„ „ 14	33·70	...	...	2·0 S.	Up.	
	„ „ 23	36·42	...	...	1·8 S.	Up.	
	„ „ 34	29·92	88·5	2·32	Away	...	
XVII *b*.—19th April 1883.	19 19 28	31·34	89·9	1·40	Away.	...	P.
	„ „ 37	29·80	...	...	3·0 N.	Down.	
	„ „ 46	28·51	...	...	2·5 N.	Down.	
	„ „ 55	27·53	...	...	2·3 N.	Down.	
	„ 20 4	24·79	...	...	2·0 N.	Down.	
	„ „ 14	39·81	...	...	1·8 N.	Up.	
	„ „ 23	37·32	...	...	2·0 N.	Up.	
	„ „ 31	35·26	...	...	2·3 N.	Up.	
	„ „ 39	34·45	...	...	2·5 N.	Up.	
	„ „ 47	33·28	...	...	3·0 N.	Up.	
	„ „ 57	31·70	90·0	1·40	Away.	...	
	„ 21 5	30·09	...	...	3·0 S.	Down.	
	„ „ 16	28·81	...	...	2·5 S.	Down.	
	„ „ 24	27·89	...	...	2·3 S.	Down.	
	„ „ 34	25·22	...	...	2·0 S.	Down.	
	„ „ 45	40·21	...	...	1·8 S.	Up.	
	„ „ 54	37·51	...	...	2·0 S.	Up.	
	„ 22 2	35·34	...	...	2·3 S.	Up.	
	„ „ 10	34·51	...	...	2·5 S.	Up.	
	„ „ 20	33·33	...	...	3·0 S.	Up.	
	„ „ 30	31·79	90·1	1·40	Away.	...	
XVIII.—29th January 1884.	29 19 25	37·17	82·7	1·42	Away.	...	P. and V. G. G.
	„ „ 37	34·86	...	...	3·0 N.	Down.	
	„ „ 48	34·27	...	...	2·8 N.	Down.	
	„ „ 57	33·90	...	...	2·7 N.	Down.	
	„ 20 5	33·49	...	..	2·6 N.	Down.	
	„ „ 12	32·99	...	...	2·5 N.	Down.	
	„ „ 30	42·33	...	...	2·5 N.	Up.	
	„ „ 37	41·68	...	...	2·6 N.	Up.	
	„ „ 45	41·09	...	...	2·7 N.	Up.	
	„ „ 53	40·59	...	..	2·8 N.	Up.	
	„ 21 2	39·84	...	...	3·0 N.	Up.	
	„ „ 13	37·15	83·2	1·42	Away.	...	
	„ „ 22	34·77	...	...	3·0 S.	Down.	
	„ „ 30	34·21	...	...	2·8 S.	Down.	
	„ „ 38	33·88	...	...	2·7 S.	Down.	
	„ „ 46	33·49	...	...	2·6 S.	Down.	
	„ „ 53	33·00	...	...	2·5 S.	Down.	
	„ 22 7	41·83	...	...	2·5 .	Up.	
	„ „ 15	41·22	...	...	2·6 S.	Up.	
	„ „ 23	40·69	...	...	2·7 S.	Up.	
	„ „ 30	40·25	...	...	2·8 S.	Up.	
	„ „ 37	39·56	...	...	3·0 S.	Up.	
	„ „ 46	37·09	83·7	1·42	Away.	...	

Number and date of Experiment.	Local Time by Magnetograph Clock.	Vertical Force Magnetograph. — Scale reading.	Thermometer.	Vacuum Gauge.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.						
XIX.—6th March 1885.	6 19 22	35·28	86·0	1·58	Away.	...	V. N. and P.
	„ „ 33	33·81	...	...	3·0 N.	Down.	
	„ „ 43	32·69	...	...	2·5 N.	Down.	
	„ „ 53	31·88	...	...	2·3 N.	Down.	
	„ 20 3	29·88	...	...	2·0 N.	Down.	
	„ „ 13	27·20	...	...	1·8 N.	Down.	
	„ „ 34	48.40	...	...	1·8 N.	Up.	
	„ „ 43	43·00	...	...	2·0 N.	Up.	
	„ „ 51	39·81	...	...	2·3 N.	Up.	
	„ „ 59	38·80	...	...	2·5 N.	Up.	
	„ 21 9	37·30	...	...	3·0 N.	Up.	
	„ „ 17	35·44	86·1	1·58	Away.	...	
	„ „ 27	33·67	...	...	3·0 S.	Down.	
	„ „ 35	32·50	...	...	2·5 S.	Down.	
	„ „ 42	31·77	...	...	2·3 S.	Down.	
	„ „ 50	29·72	...	...	2·0 S.	Down.	
	„ 22 0	27·00	...	...	1·8 S.	Down.	
	„ „ 15	47·81	...	...	1·8 S.	Up.	
	„ „ 23	42·80	...	...	2·0 S.	Up.	
	„ „ 30	39·69	...	...	2·3 S.	Up.	
	„ „ 37	38·60	...	...	2·5 S.	Up.	
	„ „ 44	37·12	...	...	3·0 S.	Up.	
	„ „ 54	35·28	86·5	1·58	Away.	...	
XX.—29th January 1886.	29 20 47	34·11	86·4	1·81	Away.	...	V. N. and P.
	„ „ 56	32·20	...	...	3·0 N.	Down.	
	„ 21 4	30·80	...	...	2·5 N.	Down.	
	„ „ 11	29·70	...	...	2·3 N.	Down.	
	„ „ 19	26·29	...	...	2·0 N.	Down.	
		Scale moving			1·8 N.	Down.	
		Magnet unstable.			1·8 N.	Up.	
	„ „ 49	42·67	...	...	2·0 N.	Up.	
	„ „ 58	38·99	...	...	2·3 N.	Up.	
	„ 22 5	37·83	...	...	2·5 N.	Up.	
	„ „ 12	36·24	...	...	3·0 N.	Up.	
	„ „ 19	34·20	86·9	1·81	Away.	...	
	„ „ 34	32·00	...	...	3·0 S.	Down.	
	„ „ 42	30·61	...	...	2·5 S.	Down.	
	„ „ 50	29·42	...	...	2·3 S.	Down.	
	„ 23 0	26·13	...	...	2·0 S.	Down.	
	„ „ 11	42·08	...	...	2·0 S.	Up.	
	„ „ 19	38·85	...	...	2·3 S.	Up.	
	„ „ 27	37·61	..	...	2·5 S.	Up.	
	„ „ 34	36·07	...	...	3·0 S.	Up.	
	„ „ 42	34·07	86·8	1·81	Away.	...	
XXI.—18th February 1886.	18 19 35	29·87	86·1	1·54	Away.	...	V. N. and P.
	„ „ 48	27·67	...	...	3·0 N.	Down.	
	„ 20 2	25·22	...	...	2·5 N.	Down.	
	„ „ 13	23·20	...	...	2·3 N.	Down.	
	„ „ 36	40·08	...	...	1·8 N.	Up.	
	„ „ 48	36·92	...	...	2·0 N.	Up.	
	„ „ 59	34·50	...	...	2·3 N.	Up.	
	„ 21 7	33·41	...	...	2·5 N.	Up.	
	„ „ 18	31·99	...	...	3·0 N.	Up.	
	„ „ 29	30·00	86·8	1·54	Away.	...	
	„ „ 40	27·65	...	...	3·0 S.	Down.	
	„ „ 58	25·65	...	...	2·5 S.	Down.	
	„ 22 10	23·80	...	...	2·3 S.	Down.	

TABLE 3—*continued.*

Number and date of Experiment.	Local Time by Magneto-graph Clerk.	Vertical Force Magneto-graph. — Scale reading.	Ther-mome-ter.	Va-cuum Gauge.	MAGNET E 1. Dis-tance in feet.	MAGNET E 1. North end.	Obser-ver.
	d. h. m.						
XXI.—18th February, 1886—*contd.*	18 22 28	40·25	...	...	1·8 S.	Up.	V. N. and P.
	,, ,, 40	37·02	...	...	2·0 S.	Up.	
	,, ,, 49	34·38	...	...	2·3 S.	Up.	
	,, ,, 56	33·40	...	...	2·5 S.	Up.	
	,, 23 6	32·03	...	...	3·0 S.	Up.	
	,, ,, 17	29·99	86·8	1·54	Away.	...	
XXII.—29th January 1887.	29 19 15	28·58	86·7	1·64	Away.	...	P. and V. G. G.
	,, ,, 47	22·17	...	...	2·3 N.	Down.	
	,, ,, 56	23·94	...	...	2·5 N.	Down.	
	,, 20 6	26·15	...	...	3·0 N.	Down.	
	,, ,, 16	28·38	86·9	1·64	Away.	...	
	,, ,, 26	30·31	...	...	3·0 N.	Up.	
	,, ,, 34	31·52	...	...	2·5 N.	Up.	
	,, ,, 42	32·39	,,	...	2·3 N.	Up.	
	,, ,, 50	34·98	...	...	2·0 N.	Up.	
	,, ,, 58	37·34	...	...	1·8 N.	Up.	
	,, 21 17	29·20	87·0	1·64	Away.	...	
	,, ,, 36	37·60	...	...	1·8 S.	Up.	
	,, ,, 45	35·28	...	...	2·0 S.	Up.	
	,, ,, 53	33·20	...	...	2·3 S.	Up.	
	,, 22 2	32·33	...	...	2·5 S.	Up.	
	,, ,, 11	30·98	...	,,	3·0 S.	Up.	
	,, ,, 22	29·17	87·2	1·64	Away.	...	
	,, ,, 30	27·02	...	...	3·0 S.	Down.	
	,, ,, 38	25·07	...	...	2·5 S.	Down.	
	,, ,, 46	23·20	...	...	2·3 S.	Down.	
	,, ,, 59	28·69	87·2	1·64	Away.	...	
XXIII *a*.—4th—5th February 1887.	4 21 19	32·01	86·7	1·59	Away.	...	P. and G. S. J.
		Scale moving Magnet unstable			2·0 N.	Down.	
	,, ,, 40	26·65	...	...	2·3 N.	Down.	
	,, ,, 49	28·08	...	...	2·5 N.	Down.	
	,, 22 2	29·77	,,	...	3·0 N.	Down.	
	,, ,, 16	31·78	86·9	1·59	Away.	...	
	,, ,, 30	33·86	...	...	3·0 N.	Up.	
	,, ,, 40	35·28	...	...	2·5 N.	Up.	
	,, ,, 48	36·28	...	...	2·3 N.	Up.	
	,, ,, 57	38·99	...	...	2·0 N.	Up.	
	,, 23 7	43·10	...	...	1·8 N.	Up.	
	,, ,, 17	32·32	87·2	1·59	Away.	...	
	,, ,, 36	43·41	...	...	1·8 S.	Up.	
	,, ,, 45	39·59	...	...	2·0 S.	Up.	
	,, ,, 54	36·81	...	...	2·3 S.	Up.	
	5 0 2	35·80	...	...	2·5 S.	Up.	
	,, ,, 12	34·29	...	...	3·0 S.	Up.	
	,, ,, 23	32·33	87·5	1·59	Away.	...	
	,, ,, 34	30·31	...	...	3·0 S.	Down.	
	,, ,, 44	28·61	...	...	2·5 S.	Down.	
	,, ,, 52	27·21	...	...	2·3 S.	Down.	
	,, 1 8	31·72	87·5	1·59	Away.	...	
XXIII *b*.—18th February 1887.	18 19 17	35·12	86·3	1·94	Away.	...	P. and D.
	,, ,, 45	21·89	...	...	1·8 N.	Down.	
	,, ,, 54	27·19	...	...	2·0 N.	Down.	
	,, 20 3	30·20	...	...	2·3 N.	Down.	
	,, ,, 10	31·31	...	...	2·5 N.	Down.	
	,, ,, 18	32·85	...	...	3·0 N.	Down.	
	,, ,, 27	34·86	86·5	1·94	Away.	...	
	,, ,, 36	36·99	...	...	3·0 N.	Up.	
	,, ,, 45	38·61	...	...	2·5 N.	Up.	
	,, ,, 52	39·90	...	...	2·3 N.	Up.	

Number and date of Experiment.	Local Time by Magneto-graph Clock.	Vertical Force Magneto-graph. — Scale reading.	Ther-mome-ter.	Va-cuum Gauge.	MAGNET E 1. Dis-tance in feet.	MAGNET E 1. North end.	Obser-ver.
	d. h. m.						
XXIII *b*.—18th February 1887—*contd.*	18 21 1	43·78	...	...	2·0 N.	Up.	P. and D.
	,, ,, 17	35·10	86·8	1·94	Away.	...	
	,, ,, 32	43·74	...	...	2·0 S.	Up.	
	,, ,, 42	40·00	...	...	2·3 S.	Up.	
	,, ,, 50	38·71	...	...	2·5 S.	Up.	
	,, 22 3	37·06	...	...	3·0 S.	Up.	
	,, ,, 17	35·09	86·8	1·94	Away.	...	
	,, ,, 30	33·11	...	...	3·0 S.	Down.	
	,, ,, 39	31·62	...	...	2·5 S.	Down.	
	,, ,, 48	30·59	...	...	2·3 S.	Down.	
	,, ,, 56	27·70	...	...	2·0 S.	Down.	
	,, 23 8	22·99	...	...	1·8 S.	Down.	
	,, ,, 17	34·59	86·9	1·94	Away.	...	
XXIV.—18th May 1888.	18 19 17	31·11	93·4	2·10	Away.	...	V. N. and V. G. G.
	,, ,, 36	23·20	...	...	1·8 N.	Down.	
	,, ,, 44	25·79	...	...	2·0 N.	Down.	
	,, ,, 52	27·79	...	...	2·3 N.	Down.	
	,, 20 0	28·52	...	...	2·5 N.	Down.	
	,, ,, 8	29·58	...	...	3·0 N.	Down.	
	,, ,, 16	30·92	93·8	2·10	Away.	...	
	,, ,, 28	32·30	...	...	3·0 N.	Up.	
	,, ,, 36	33·25	...	...	2·5 N.	Up.	
	,, ,, 44	33·91	...	...	2·3 N.	Up.	
	,, ,, 52	35·50	...	...	2·0 N.	Up.	
	,, 21 0	37·38	...	...	1·8 N.	Up.	
	,, ,, 16	31·12	93·9	2·10	Away.	...	
	,, ,, 30	37·46	...	...	1·8 S.	Up.	
	,, ,, 38	35·66	...	...	2·0 S.	Up.	
	,, ,, 46	34·10	...	...	2·3 S.	Up.	
	,, ,, 57	33·43	...	...	2·5 S.	Up.	
	,, 22 7	32·49	...	...	3·0 S.	Up.	
	,, ,, 17	31·12	93·9	2·10	Away.	...	
	,, ,, 29	29·72	...	...	3·0 S.	Down.	
	,, ,, 38	28·69	...	...	2·5 S.	Down.	
	,, ,, 46	27·91	...	...	2·3 S.	Down.	
	,, ,, 56	25·99	...	...	2·0 S.	Down.	
	,, 23 8	23·26	...	...	1·8 S.	Down.	
	,, ,, 17	30·81	94·0	2·10	Away.	...	
XXV.—8th—9th May 1889.	8 20 20	30·76	92·5	2·28	Away.	...	V. N. and V. G. G.
	,, ,, 39	23·20	...	...	1·8 N.	Down.	
	,, ,, 44	25·51	...	...	2·0 N.	Down.	
	,, ,, 52	27·40	...	...	2·3 N.	Down.	
	,, 21 0	28·18	...	...	2·5 N.	Down.	
	,, ,, 8	29·22	...	...	3·0 N.	Down.	
	,, ,, 17	30·60	92·7	2·28	Away.	...	
	,, ,, 27	31·89	...	...	3·0 N.	Up.	
	,, ,, 35	32·82	...	...	2·5 N.	Up.	
	,, ,, 45	33·49	...	...	2·3 N.	Up.	
	,, ,, 52	35·00	...	...	2·0 N.	Up.	
	,, 22 0	36·82	...	...	1·8 N.	Up.	
	,, ,, 21	30·81	92·8	2·28	Away.	...	
	,, ,, 32	36·89	...	...	1·8 S.	Up.	
	,, ,, 40	35·19	...	...	2·0 S.	Up.	
	,, ,, 50	33·62	...	...	2·3 S.	Up.	
	,, 23 0	33·00	...	...	2·5 S.	Up.	
	,, ,, 8	32·08	...	...	3·0 S.	Up.	
	,, ,, 16	30·79	92·9	2·28	Away.	...	
	,, ,, 27	29·38	...	...	3·0 S.	Down.	
	,, ,, 35	28·31	...	...	2·5 S.	Down.	
	,, ,, 42	27·58	...	...	2·3 S.	Down.	
	,, ,, 51	25·68	...	...	2·0 S.	Down.	
	9 0 0	23·14	...	...	1·8 S.	Down.	
	,, ,, 21	30·49	92·9	2·28	Away.	...	

Appendix I, 1879—82, paragraph 28.

8. Appendix I, 1879—82, paragraphs 29 to 40. In view of the improvement that was found to attend the practice described at the foot of paragraph 30 of Appendix I, 1879—82, and in order to embody the subsidiary angles of deflection observed regularly with the Kew Unifilar magnetometer, a somewhat fuller and more connected statement of the theory of the deflection observations in the horizontal plane appears to be desirable. As stated in the last foot-note to Table 3, page [19], and in paragraph 39 of Appendix I, 1879—82, the subsidiary deflections were at first designed merely to indicate the changes of strength of the deflector magnet E 1, but they will now be treated as furnishing relative measures of that strength. In addition to the symbols adopted in Appendix I, 1879—82, paragraphs 21 and 24, let us further define :—

x ; X_1 ; $X_\circ$ = the horizontal force at the times of—(1)the deflection of magnet N 3, (2) the subsidiary deflection of magnet N 23c made, at 1·0 foot distance, with the Kew Unifilar, and (3) the same in a case taken as a standard case—all observed in the Electrometer Tower.

M ; M_1 ; $M_\circ$ = the magnetic moment of the deflector magnet E 1 at the same three times respectively.

$\frac{d}{2}$; u ; $u_\circ$ = the single angles of deflection in the three respective observations, the first being expressed in scale-divisions and the two last in arc.

a^1 = the value of one division of the scale of the apparatus used for the deflection of magnet N 3 by magnet E 1.

$1+\frac{\pi}{F}$ = the torsion coefficient of the thread that supports the magnet N 3.

r = the distance apart of the middle points of the deflector and deflected magnets.

Then the deflections of the magnet N 3 give us

$$Y = xa^1 \left(1+\tfrac{\pi}{F}\right) \tfrac{d}{2} \qquad (1)$$

and considering the relative positions of the deflector and deflected magnets, the former being side-on to the latter, we have also

$$Y = \tfrac{M}{r^3}\left(1+\tfrac{p}{r^2}\right), \text{ where } p \text{ is a constant.} \qquad (2)$$

The subsidiary deflections of magnet N 23c by magnet E 1, the latter being end-on to the former, give — in the current and standard observations respectively

$$\frac{2M}{X_1}\frac{1}{r_\circ^3}\left(1+\frac{p^1}{r_\circ^2}\right) = \sin u \text{ and} \qquad (3)$$

$$\frac{2M_\circ}{X_\circ}\frac{1}{r_\circ^3}\left(1+\frac{p^1}{r_\circ^2}\right) = \sin u_\circ \qquad (4)$$

or dividing equation (3) by equation (4),

$$\frac{X_\circ}{X_1}\cdot\frac{M}{M_\circ} = \frac{\sin u}{\sin u_\circ} \text{ or } M = \frac{M_\circ}{X_\circ \sin u_\circ}\cdot X_1 \sin u.$$

Let $\frac{M_\circ}{X_\circ \sin u_\circ} = J$ — a constant, when—inserting the value of M in it— (5)

equation (2) becomes

$$Y = JX_1 \sin u \frac{1}{r^3}\left(1+\frac{p}{r^2}\right), \text{ whence, having regard to equation (1),} \qquad (6)$$

$$J = \frac{x}{X_1}\frac{a^1\left(1+\frac{\pi}{F}\right)}{2\sin u}\frac{d}{\frac{1}{r^3}\left(1+\frac{p}{r^2}\right)}. \qquad (7)$$

9. In accordance with our rule (Appendix I, 1879—82, para. 38) of rejecting from consideration quantities that affect the scale-co-efficient by less than $\frac{1}{200}$th of itself, we may substitute unity for $\frac{x}{X_1}$ whenever it lies between ·995 and 1·005, or whenever $\frac{X_1-x}{X_1}$ or $\frac{\Delta X}{X_1}$ lies between $\pm$ ·005, or whenever the difference of the scale-readings of the large hori-

zontal force magnetometer, taken at the times of the deflections of magnet N 3 and of magnet N 23c, lies between $\pm \frac{\cdot 005}{\cdot 0015}$ or between $\pm$ 3·3 scale-divisions: practically this is always the case, and we may use x and X_1, or X the mean value of the horizontal force for the month in which the deflection experiments are made, its secular annual and diurnal variations during a month being negligible, indifferently. Equations (6) and (7) thus become

$$Y = JX \sin u \frac{1}{r^3}\left(1 + \frac{p}{r^2}\right) \tag{8}$$

$$J = \frac{a^1\left(1 + \frac{H}{F}\right)}{2 \sin u} \frac{d}{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)} \tag{9}$$

These are the values of Y and J given by a single deflection observation when the distance between the magnets N 3 and E 1 is r, but we have seen reason to believe (Appendix I, 1879—82, paragraph 34,) that the probable errors of the deflections—great or small—are about equal, and as there will obviously be some compensation of errors in adding the deflections together, thus also giving them weight in proportion to their values, we have decided—on the same principle as in Appendix I, 1879—82, paragraphs 33 and 92—to adopt, as the most probable value of J for a full experiment, that which is given by the formula

$$J = \frac{a^1\left(1 + \frac{H}{F}\right)}{2 \sin u} \frac{\Sigma d}{\Sigma\left\{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)\right\}} \tag{10}$$

Σd embracing all the double deflections except the largest, and $\Sigma\left\{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)\right\}$ the values of the quantity under the Σ for all the corresponding values of r.

10. The first step taken with the deflections in the horizontal plane—those of magnet N 3 by magnet E 1—was, as in Appendix I, 1879—82, paragraph 29, to calculate the constant p which depends on the distribution of the magnetism of the two magnets. For this purpose, and for this purpose alone, a large deflection was observed, with the magnets at the near distance 1·08 feet, as part of each set of experiments made since the 14th April 1883, for suitable combination with all the other deflections taken together. Calling the double of this large deflection d^1, it gives by itself, the corresponding distance being r_1,

$$J = \frac{a^1\left(1 + \frac{H}{F}\right)}{2 \sin u} \frac{d^1}{\frac{1}{r_1^3}\left(1 + \frac{p}{r_1^2}\right)} \tag{11}$$

and comparing equations (10) and (11) we have

$$\frac{\Sigma d}{\Sigma\left\{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)\right\}} = \frac{d^1}{\frac{1}{r_1^3}\left(1 + \frac{p}{r_1^2}\right)}, \text{ whence} \tag{12}$$

$$p = \frac{d^1 \Sigma \frac{1}{r^3} - \frac{1}{r_1^3}\Sigma d}{\frac{\Sigma d}{r_1^5} - d^1 \Sigma \frac{1}{r^5}} \tag{13}$$

11. In the following table are collected together the data furnished by all the deflection experiments for the calculation of p and the results given by embodying the significant quantities of each experiment in equation (13).

TABLE 4.

Deflections of magnet N 3 by magnet E 1, side-on: data for calculation of p and result for each experiment of Table 2.

[Corresponding to Table 6 of Appendix I, 1889-82.]

No. of Experiment.	Date.	Double Deflection in Scale-divisions. d^1	d Distance in feet. 1·08	1·8	2·0	2·3	2·5	2·6	2·7	2·8	3·0	Σd	$\frac{1}{r_1^3}$	$\frac{1}{r_1^5}$	$\Sigma \frac{1}{r^3}$	$\Sigma \frac{1}{r^5}$	Deduced value of p	Values of p used in calculations.
XVII ...	14th April 1883 ...	25·93	5·19	3·79	2·40	1·92	...	...	...	1·07	14·37	·79383	·68058	·47970	·11407	+·15116		
XVIII ...	30th January 1884 ...	26·01	...	...	...	1·83	1·61	1·45	1·30	1·08	7·27	·79383	·68058	·25430	·03556	+·20960		
XIX ...	7th March 1885 ...	25·73	5·07	3·59	2·40	1·84	...	..	...	1·04	13·94	·79383	·68058	·47970	·11407	+·19481		+·18450
XX ...	28th January 1886 ...	25·79	5·08	3·72	2·39	1·85	...	...	...	1·07	14·11	·79383	·68058	·47970	·11407	+·17523		
XXI ...	19th February 1886 ...	25·77	5·04	3·65	2·38	1·86	...	...	...	1·06	13·99	·79383	·68058	·47970	·11407	+·19169		
XXII ...	28th January 1887 ...	25·64	5·07	3·65	2·37	1·84	..	...	...	1·07	14·00	·79383	·68058	·47970	·11407	+·17978		+·18075
XXIII ...	5th February 1887 ...	25·72	5·09	3·64	2·36	1·87	...	...	...	1·07	14·03	·79383	·68058	·47970	·11407	+·18172		
XXIV ...	19th May 1888 ...	25·36	5·05	3·61	2·33	1·82	...	...	...	1·03	13·84	·79383	·68058	·47970	·11407	+·18053		+·18140
XXV ...	9th May 1889 ...	25·27	5·02	3·61	2·36	1·83	...	..	...	1·06	13·88	·79383	·68058	·47970	·11407	+·16812		
																Mean value of p=		+·18140

12. The agreement of the values of p furnished by single experiments is, as it was expected to be, much greater than was found in Table 6, Appendix I, 1879—82, page [28], for groups of experiments, when only small deflections were available and made use of: indeed, the mean (0·18140) of the nine values now found may be regarded as differing from any of the individual values only by the probable error of observation, and we may adopt that value as applicable to the whole period from 14th April 1883 to 9th May 1889, and even for some time to come, so long as future determinations keep within similar limits to those that enclose the nine values now found. As, however, provisional values of 0·18450 for the period 14th April 1883 to 19th February 1886 and 0·18075 for the experiments of 28th January and 5th February 1887, have already been made use of in the reductions for those periods respectively, and as no error of $\frac{1}{1000}$th even of the whole force will be hereby involved, these reductions will not be gone over again.

13. Now, substituting for p the number 0·18140, and inserting the values of the several data shown in the following table, in equation (10), we obtain for the values of J given by the several experiments the numbers shown in column 8 of the table.

TABLE 5.

Deflections of magnet N 3 by magnet E 1; data for calculation of J and result for each experiment of Table 2.

No. of Experiment.	Date.	a^1.	$1 + \frac{H}{F}$	u.	Σd.	$\Sigma\left\{\frac{1}{r^3}\left(1+\frac{p}{r^2}\right)\right\}$	J.	Mean values of J.	Values of J used in calculation of Y.
1	2	3	4	5	6	7	8	9	10
				° ′ ″					
XVII ...	14th April 1883 ...	·00416	1·00101	6 50 22	14·37	·50040	·50208		
XVIII ...	30th January 1884.	·00416	1·00143	6 48 15	7·27	·26075	·49018		
XIX ...	7th March 1885...	·00416	1·00194	6 46 42	13·94	·50040	·49187	·49636	·49624
XX ...	28th January 1886.	·00416	1·00135	6 43 57	14·11	·50040	·50097		
XXI ...	19th February 1886	·00416	1·00127	6 43 55	13·99	·50040	·49670		
XXII ...	28th January 1887.	·00416	1·00146	6 42 7	14·00	·50040	·49936		
XXIII ...	5th February 1887	·00416	1·00141	6 42 7	14·03	·50040	·50040	·49979	·49995
XXIV ...	19th May 1888 ...	·00416	1·00119	6 38 2	13·84	·50040	·49857		
XXV ...	9th May 1889 ...	·00416	1·00159	6 37 32	13·88	·50040	·50083		·49979

14. The degree of consistency with each other of the different values of J, which is theoretically a constant, still leaves much to be desired, at least as regards the first five values, for the greatest and least of these five values differ from the mean of them all by about $\frac{1}{80}$th of the whole; but, for some reason that we have as yet found no clue to, the last four values agree with each other so remarkably well that no further improvement in that respect can reasonably be looked for in future determinations. The comparison of the values of D shown in Appendix I, 1879—82, Table 10, column 3, page [31] exhibits, however, discrepancies of a much larger order than are now found in the values of J, even those of the first five experiments; and the great improvement is, no doubt, mainly a consequence of the later practice of observing a large deflection for use in the determination of p, though if confirmation were wanted of this, it is found in the contrary variations of D and p—the latter as exhibited in Appendix I, 1879—82, Table 6, page [28].

In view of the great difference of quality above described of the first five and last four values of J, the respective means, 0·49636 and 0·49979, would have been appropriate for adoption for the respective periods 14th April 1883 to 19th February 1886 and 28th January 1887 to 9th May 1889; but a provisional value of 0·49624 having been already used in the reductions of the first period, these are allowed to stand, as are also reductions with a similar provisional value of 0·49995 for the period 28th January to 5th February 1887, and for the period 19th May 1888 to 9th May 1889 the mean 0·49979 has actually been adopted. It will be observed that the difference, in each case, between the adopted and the more appropriate values is much within $\frac{1}{1000}$ th of the whole.

15. For the reasons given in Appendix I, 1879—82, paragraph 28, we may continue to regard the distribution of magnetism in the vertical force magnet and in the magnet N 3 as practically similar, and hence remembering that the disposition of the deflector and deflected magnets in the vertical and horizontal deflection experiments respectively is such as is described in Appendix I, 1879—82, paragraph 25, and is symmetrical in the two cases, the intensity of the disturbing force produced by the action of the deflector magnet E 1 upon the deflected magnet is, when the magnets are the same distance apart, the same in both cases. Having therefore ascertained that in the case of the horizontal deflections the disturbing force, for different distances, is expressed by equation (8), we may apply that equation to calculate the disturbing forces, for different distances, in the case of the vertical deflections, and this is what has been done by means of the data shown in the following two tables.

TABLE 6.

Data used for calculation of Y by means of equation (8).

No. of Experiment.	Date.	J.	X.	Sin u.	JX sin u.	p.
XVII ...	14th April 1883 ...	·49624	3·7324	·11909	·22056	+·18450
XVIII ...	30th January 1884 ...	·49624	3·7391	·11848	·21982	+·18450
XIX ...	7th March 1885 ...	·49624	3·7437	·11803	·21951	+·18450
XX ...	28th January 1886 ...	·49624	3·7406	·11723	·21760	+·18450
XXI ...	19th February 1886 ...	·49624	3·7406	·11722	·21758	+·18450
XXII ...	28th January 1887 ...	·49995	3·7403	·11671	·21822	+·18075
XXIII ...	5th February 1887 ...	·49995	3·7403	·11671	·21822	+·18075
XXIV ...	19th May 1888 ..	·49979	3·7409	·11552	·21599	+·18140
XXV ...	9th May 1889 ...	·49979	3·7425	·11538	·21581	+·18140

TABLE 7.

Further data used for calculation of Y, viz., values of $\frac{1}{r^3}\left(1+\frac{p}{r^2}\right)$

[Corresponding to Table 12 of Appendix I, 1879—82.]

r in feet.	p.		
	+·18450.	+·18075.	+·18140.
1·8	·18123	·18104	·18107
2·0	·13077	·13065	·13067
2·3	·08506	·08500	·08501
2·5	·06589	·06585	·06586
2·6	·05845	.....	.....
2·7	·05210	.....	.....
2·8	·04662	.....	.....
3·0	·03780	·03778	·03779

By multiplying the number of a particular experiment taken from the last column but one of Table 6 successively by the several numbers from Table 7 corresponding to the values of r and p for that experiment, we obtain the set of values of Y for that experiment: these are entered in column 3 of Table 10.

16. Appendix I, paras. 41 to 46. The paragraphs here referred to were devoted mainly to an investigation of the curvature of the knife-edge of the vertical force magnet the principal result of which is embodied in Table 16, column 4*b* (Appendix I, 1879—82, page [38]), the numbers in which are measures of the quantity $\frac{\Delta(w\omega)}{\Delta s}$ for each interval of a scale-division between 23 and 44. These numbers we shall adopt as they stand, and the first use we shall make of them is to find the integral numbers for each scale-division of which they are the increments *per* scale-division in order.

TABLE 8.

[Derived from Table 16 of Appendix I, 1879—82.]

Scale-divisions.	Increments $\frac{\Delta(w\omega)}{\Delta s}$ in inches.	Integral values of $(w\omega)$ in inches.	$\frac{\cdot46108}{12} Wg \times (w\omega)$	
			W=1802·6.	g=32·108.
1	2	3	4	
23		—·00000358	—·0079616	
24	+·00000082	—·00000276	—·0061380	
25	+·00000071	—·00000205	—·0045590	
26	+·00000060	—·00000145	—·0032247	
27	+·00000049	—·00000096	—·0021349	
28	+·00000038	—·00000058	—·0012899	
29	+·00000028	—·00000030	—·0006672	
30	+·00000018	—·00000012	—·0002669	
31	+·00000010	—·00000002	—·0000445	
32	+·00000002	·00000000	·0000000	
33	·00000000	·00000000	·0000000	
34	·00000000	·00000000	·0000000	
35	·00000000	·00000000	·0000000	
36	·00000000	·00000000	·0000000	
37	+·00000004	+·00000004	+·0000890	
38	+·00000012	+·00000016	+·0003558	
39	+·00000020	+·00000036	+·0008006	
40	+·00000029	+·00000065	+·0014455	
41	+·00000038	+·00000103	+·0022906	
42	+·00000048	+·00000151	+·0033581	
43	+·00000058	+·00000209	+·0046480	
44	+·00000068	+·00000277	+·0061602	

17. Appendix I, 1879—82, paragraph 47. In the next place, we require to know the value of m, the magnetic moment of the vertical force magnet at the times of the several deflection experiments in the vertical plane: two such values were determined on the 20th December 1871 and on the 14th January 1880 and are given in the paragraph referred to, being 0·681 and 0·595 respectively expressed in British units: another determination made in the same manner by using the vertical force magnet to deflect the magnet N 23c in the Kew Unifilar magnetometer on the 31st January 1887 gave the angle of deflection 8° 7′ 57″ and the value of m 0·574. Before we had to assume that the rate of change of m was uniform, only two values being available from which to determine it, but now having three values we are able to take into account the gradual diminution of the rate of fall of m, and for this purpose we have adopted the formula $m = 0{\cdot}681 - a \log_{10} \frac{A+t}{A}$ where a and A are constants and t is the time, reckoned in months, since the date of the first determination. By a method of successive approximation the three known values of m and the corresponding times gave to $\log_{10} a$ the value 8·91774 and to A the value 9·73; and with these embodied in the formula, the values of m calculated for the 1st April of each of the years 1879 to 1891 were found to be as follows:—

TABLE 9.

Year (1st April).	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
m	·598	·594	·590	·587	·584	·581	·578	·576	·574	·571	·569	·567	·566

From these annual values, the particular values of m for the times of the several deflection experiments were found by simple interpolation.

18. Appendix I, 1879—82, paragraph 48. We have now, as in the paragraph here referred to, to divide the several values of $\frac{46108}{12} Wg\ (wo)$ given in column 4 of Table 8 by the appropriate value of m corresponding to the time of a particular experiment, and we thus obtain the several values of $\frac{Wg}{m}\ (wo)$ (in m. m.—m. g.—s units) corresponding to the integral values 23 to 44 of the scale-readings to be allowed for in that experiment; in doing this the values that have been adopted are—of W (since the 20th January 1880) 1802·6 and of g 32·108.

From the values of $\frac{Wg}{m}\ (wo)$ for the integral values of s, its values for the several actual scale-readings of an experiment are obtained by interpolation; and these values are entered in column 4 of Table 10 opposite to the several scale-readings to which they correspond in the several experiments.

19. The order, described in Appendix I, 1879—82, paragraph 64, in which deflection experiments have been made upon the vertical force magnetograph,—*viz:* first to bring the deflector magnet up, step by step, from a distant to a near position, then to reverse the direction of the deflector and move it step by step, to the distant position, and finally to repeat the operations in the same order with the deflector moved over to the other arm of the deflection ring—was continued until the 18th February 1886; and the small corrections that were required to the scale-readings, to bring the four sets of increasing or decreasing numbers into relation with a practically constant value of the scale-reading with the magnet away, were +0·45 for 19th April 1883;—0·08 for 29th January 1884; 0·00 for 6th March 1885;—0·04 for 29th January 1886 and +0·12 for 18th February 1886, the corrections being applied, in every case, to the first of the four sets of numbers only. After these corrections had been applied, the means were taken of the pairs of nearly equal scale-readings that result from using the deflector magnet, similarly disposed, at the same distances on both arms of the deflection ring; and these means are entered, for each experiment, in column 2 of Table 10.

Table 10.

Experimental deflections of the Vertical Force Magnetograph by the deflector Magnet E 1.

CALCULATION, FROM THE DATA IN TABLE 3, OF THE MEAN SCALE-READINGS REFERRED TO IN PARAGRAPH 19; AND VALUES OF THE CORRESPONDING DISTURBING FORCES OF PARAGRAPHS 15 AND 18.

Number and date of Experiment.	Vertical Force Magnetograph. Mean Scale-reading.	Disturbing force (Y)	$\frac{Wq}{m}$ (100)	$Y + \frac{Wq}{m}$ (100)
1	2	3	4	5
XVII*a*.				
13th April 1883.	25·59	—·00834	—·00646	—·01480
	28·06	·00000	—·00218	—·00218
	29·47	+·00834	—·00082	+·00752
	30·76	+·01453	—·00016	+·01437
	31·55	+·01876	—·00003	+·01873
	33·68	+·02884	·00000	+·02884
	36·33	+·03997	+·00005	+·04002
XVII*b*.				
19th April 1883.	25·23	—·02884	—·00784	—·03668
	27·93	—·01876	—·00263	—·02139
	28·88	—·01453	—·00151	—·01604
	30·17	—·00834	—·00050	—·00884
	31·74	·00000	—·00002	—·00002
	33·30	+·00834	·00000	+·00834
	34·48	+·01453	·00000	+·01453
	35·30	+·01876	·00000	+·01876
	37·41	+·02884	+·00034	+·02918
	40·01	+·03997	+·00252	+·04249
XVIII.				
29th January 1884.	32·95	—·01448	·00000	—·01448
	33·45	—·01285	·00000	—·01285
	33·85	—·01145	·00000	—·01145
	34·20	—·01025	·00000	—·01025
	34·77	—·00831	·00000	—·00831
	37·12	·00000	+·00020	+·00020
	39·70	+·00831	+·00215	+·01046
	40·42	+·01025	+·00310	+·01335
	40·89	+·01145	+·00379	+·01524
	41·45	+·01285	+·00476	+·01761
	42·08	+·01448	+·00598	+·02046
XIX.				
6th March 1885.	27·10	—·03978	—·00354	—·04332
	29·80	—·02871	—·00060	—·02931
	31·82	—·01867	—·00001	—·01868
	32·59	—·01446	·00000	—·01446
	33·74	—·00830	·00000	—·00830
	35·36	·00000	·00000	·00000
	37·21	+·00830	+·00025	+·00855
	38·70	+·01446	+·00116	+·01562
	39·75	+·01867	+·00222	+·02089
	42·90	+·02871	+·00780	+·03651
XX.				
29th January 1886.	26·19	—·02845	—·00520	—·03365
	29·54	—·01851	—·00077	—·01928
	30·68	—·01434	—·00019	—·01453
	32·08	—·00822	·00000	—·00822
	34·13	·00000	·00000	·00000
	36·15	+·00822	+·00002	+·00824
	37·72	+·01434	+·00049	+·01483
	38·92	+·01851	+·00132	+·01983
	42·37	+·02845	+·00667	+·03512
XXI.				
18th February 1886.	23·56	—·01851	—·01310	—·03161
	25·49	—·01434	—·00690	—·02124
	27·72	—·00822	—·00274	—·01096
	29·99	·00000	—·00046	—·00046
	32·01	+·00822	·00000	+·00822
	33·40	+·01434	·00000	+·01434
	34·44	+·01851	·00000	+·01851
	36·97	+·02845	+·00015	+·02860
	40·16	+·03943	+·00275	+·04218

Number and date of Experiment.	Vertical Force Magnetograph. Mean Scale-reading.	Disturbing force (Y)	$\frac{Wq}{m}$ (100)	$Y + \frac{Wq}{m}$ (100)
1	2	3	4	5
XXII.				
27th January 1887.	22·68	—·01855	—·01498	—·03353
	24·50	—·01437	—·00933	—·02370
	26·58	—·00825	—·00451	—·01276
	28·77	·00000	—·00144	—·00144
	30·64	+·00825	—·00022	+·00803
	31·92	+·01437	—·00002	+·01435
	32·79	+·01855	·00000	+·01855
	34·84	+·02851	·00000	+·02851
	37·18	+·03951	+·00037	+·03988
XXIII*a*.				
4th February 1887.	26·93	—·01855	—·00390	—·02245
	28·34	—·01437	—·00187	—·01624
	30·04	—·00825	—·00048	—·00873
	32·05	·00000	—·00001	—·00001
	34·07	+·00825	·00000	+·00825
	35·54	+·01437	·00000	+·01437
	36·54	+·01855	+·00008	+·01863
	39·29	+·02851	+·00172	+·03023
	43·25	+·03951	+·00877	+·04828
XXIII*b*.				
18th February 1887.	22·44	—·03951	—·01582	—·05533
	27·44	—·02851	—·00306	—·03157
	30·39	—·01855	—·00031	—·01886
	31·46	—·01437	—·00004	—·01441
	32·98	—·00825	·00000	—·00825
	34·97	·00000	·00000	·00000
	37·02	+·00825	+·00016	+·00841
	38·66	+·01437	+·00113	+·01550
	39·95	+·01855	+·00246	+·02101
	43·76	+·02851	+·01010	+·03861
XXIV.				
18th May 1888.	23·23	—·03911	—·01321	—·05232
	25·89	—·02822	—·00590	—·03412
	27·85	—·01836	—·00247	—·02083
	28·60	—·01422	—·00160	—·01582
	29·65	—·00816	—·00071	—·00887
	31·02	·00000	—·00009	—·00009
	32·39	+·00816	·00000	+·00816
	33·34	+·01422	·00000	+·01422
	34·00	+·01836	·00000	+·01836
	35·58	+·02822	·00000	+·02822
	37·42	+·03911	+·00035	+·03946
XXV.				
8th May 1889.	23·17	—·03908	—·01344	—·05252
	25·59	—·02820	—·00662	—·03482
	27·49	—·01835	—·00302	—·02137
	28·24	—·01421	—·00200	—·01621
	29·30	—·00815	—·00096	—·00911
	30·69	·00000	—·00020	—·00020
	31·98	+·00815	—·00001	+·00814
	32·91	+·01421	·00000	+·01421
	33·55	+·01835	·00000	+·01835
	35·09	+·02820	·00000	+·02820
	36·85	+·03908	+·00012	+·03920
	23·82	—·01901	—·01215	—·03116
	24·82	—·01525	—·00909	—·02434
	25·89	—·01133	—·00634	—·01767
	26·96	—·00676	—·00409	—·01085
	28·48	·00000	—·00187	—·00187
	29·71	+·00676	—·00072	+·00604
	30·91	+·01382	—·00013	+·01369
	32·10	+·01980	·00000	+·01980
	33·31	+·02636	·00000	+·02636
	34·35	+·03169	·00000	+·03169
	35·47	+·03746	·00000	+·03746
	36·42	+·04229	+·00007	+·04236
	37·50	+·04711	+·00041	+·04752
	38·64	+·05172	+·00121	+·05293
	39·79	+·05584	+·00247	+·05831
	40·95	+·05924	+·00422	+·06346
	42·26	+·06166	+·00694	+·06860
	43·22	+·06421	+·00936	, +·07357
	44·54	+·06691	.....	.....
21st September 1886.				

20. By slightly modifying the order of the vertical deflections, the continuity of the scale-readings, from the least to the greatest or *vice versâ*, has been secured without the necessity of applying corrections. Latterly the order has been to begin with the deflector magnet at the nearest distance and move it, step by step, away till the greatest distance is reached, next to take it right away and read the scale, and then to bring it back inverted in position and move it from the distant to the near position; and this being repeated with the deflector on the other arm of the deflection ring, but in the reverse order, we obtain two sets of scale-readings without any break of continuity, the means of corresponding pairs of numbers in which can be at once taken and entered in Table 10. At least this would be so, unless an accidental dislocation should occur in the motion of the vertical force magnetograph; but on the first occasion—the 29th January 1887—on which the vertical deflections were made in this order, a dislocation did apparently occur, making the scale-readings at 20h 50m and 20h 58m too great by 0·57: this was detected by curving the two sets of numbers and finding that the curves ran parallel throughout, except that the points corresponding to the times mentioned were displaced by 0·57 scale-division, this displacement was allowed for before the means were taken of corresponding pairs.

21. Care has been taken since the 29th June 1876 to move about the deflector magnet so slowly that it shall never set the vertical force magnet more than just perceptibly vibrating and—for the reason stated in Appendix I, 1879—82, paragraph 59, (4)—after a change of position of the deflector has been completed and the vertical force magnet has come sensibly to rest, an interval of ten or five minutes has always been allowed to elapse before taking a final reading for adoption—of ten minutes from 10th January 1881 to 5th June 1882 and of five minutes since the 3rd July 1882.

22. And now to find from the vertical deflections of any experiment the value of the scale-coefficient applicable to the scale-division 33·2, that experiment furnishes us with a series of equations of the form (that of equation (5*a*) of Appendix I, 1879—82, page [10])

$$(X+\frac{W_g}{m}c\sin\epsilon)\,a\,s = Y+\frac{W_g}{m}(wo)+(C-Y_1) \qquad (14)$$

in which s and $Y+\frac{W_g}{m}(wo)$ are known, and $(X+\frac{W_g}{m}c\sin\epsilon)\,a$ and $(C-Y_1)$, which are constants for that experiment, may be found by least squares. Thus calculated, the values of s and $\left\{Y+\frac{W_g}{m}(wo)\right\}$ being taken from columns 2 and 5 of Table 10, the values of $(X+\frac{W_g}{m}c\sin\epsilon)\,a$ and $(C-Y_1)$ come out for the several experiments as shown in Table 11, in which are also shown the values of m and the mean readings of the thermometer and vacuum gauge of the vertical force magnetograph for the times of the several experiments.

TABLE 11.

No. of Experiment.	Date.	m.	$C-Y_1$.	$(X+\frac{W_g}{m}c\sin\epsilon)\,a$ or $\frac{dy}{ds}$ for scale-reading 33·2.	V. F. Magnetograph.		Probable error of a single value of $\left\{Y+\frac{W_g}{m}(wo)\right\}$	Probable error of $(X+\frac{W_g}{m}c\sin\epsilon)a \div (X+\frac{W_g}{m}c\sin\epsilon)a$
					Thermometer.	Vacuum Gauge.	ϵ.	$\frac{E}{c}$.
1	2	3	4	5	6	7	8	9
XVII. *a*	13th April 1883 ...	·584	·13090	·00472	88·3	2·32	±·00053	$\pm\frac{1}{49}$
XVII. *b*	19th April 1883 ...	·584	·17080	·00536	90·0	1·40	±·00049	$\pm\frac{1}{149}$
XVIII.	29th January 1884 ...	·582	·14047	·00381	83·2	1·42	±·00027	$\pm\frac{1}{101}$
XIX.	6th March 1885 ...	·579	·17901	·00504	86·2	1·58	±·00040	$\pm\frac{1}{174}$
XX.	29th January 1886 ...	·576	·14390	·00422	86·7	1·81	±·00021	$\pm\frac{1}{290}$
XXI.	18th February 1886...	·576	·13012	·00431	86·6	1·54	±·00044	$\pm\frac{1}{124}$
XXII.	29th January 1887 ...	·574	·14585	·00501	87·0	1·64	±·00027	$\pm\frac{1}{207}$
XXIII. *a*	4th February 1887 ...	·574	·13799	·00429	87·2	1·59	±·00024	$\pm\frac{1}{267}$
XXIII. *b*	18th February 1887...	·574	·14809	·00424	86·7	1·94	±·00036	$\pm\frac{1}{172}$
XXIV.	18th May 1888 ...	·571	·19793	·00636	93·8	2·10	±·00030	$\pm\frac{1}{231}$
XXV.	8th May 1889 ...	·569	·20001	·00651	92·8	2·28	±·00011	$\pm\frac{1}{420}$
Extra.	21st September 1886 .	·575	·15001	·00528	89·3	1·57		

23. If graphical constructions be made of equation (14) on a form on which the abscissæ represent scale-readings and the ordinates vertical disturbing forces, each pair of constants $\left(X+\frac{W_g}{m}c\ sin\ \epsilon\right)a$ and $(C-Y_1)$ will be represented on that form by a straight line, and each pair of the scale-readings and vertical disturbing forces that have furnished the constants of a particular experiment will be represented by points, and the nearer these points are to coincidence with the corresponding straight line throughout its length, the greater is the probability that the straight line represents truly the scale-coefficient of the division 33·2 for that experiment. Such constructions have been made for each of the several experiments—of the straight lines from corresponding numbers of columns 5 and 4 of Table 11, and of the points from corresponding numbers of columns 2 and 5 of Table 10—and they form Figs. 1 to 11 of Plate I. The points of Figs. 1, 6, 7, 9, 10 and 11 that have the lowest scale-readings of the respective experiments, and four others, are surrounded by small circles: these points were found to deviate sensibly from the course of the straight lines to which they respectively belong; and the co-ordinates of them having therefore been excluded from the calculation of the constants of the respective straight lines, it remains to mention certain circumstances that may explain the worst of the discrepancies.

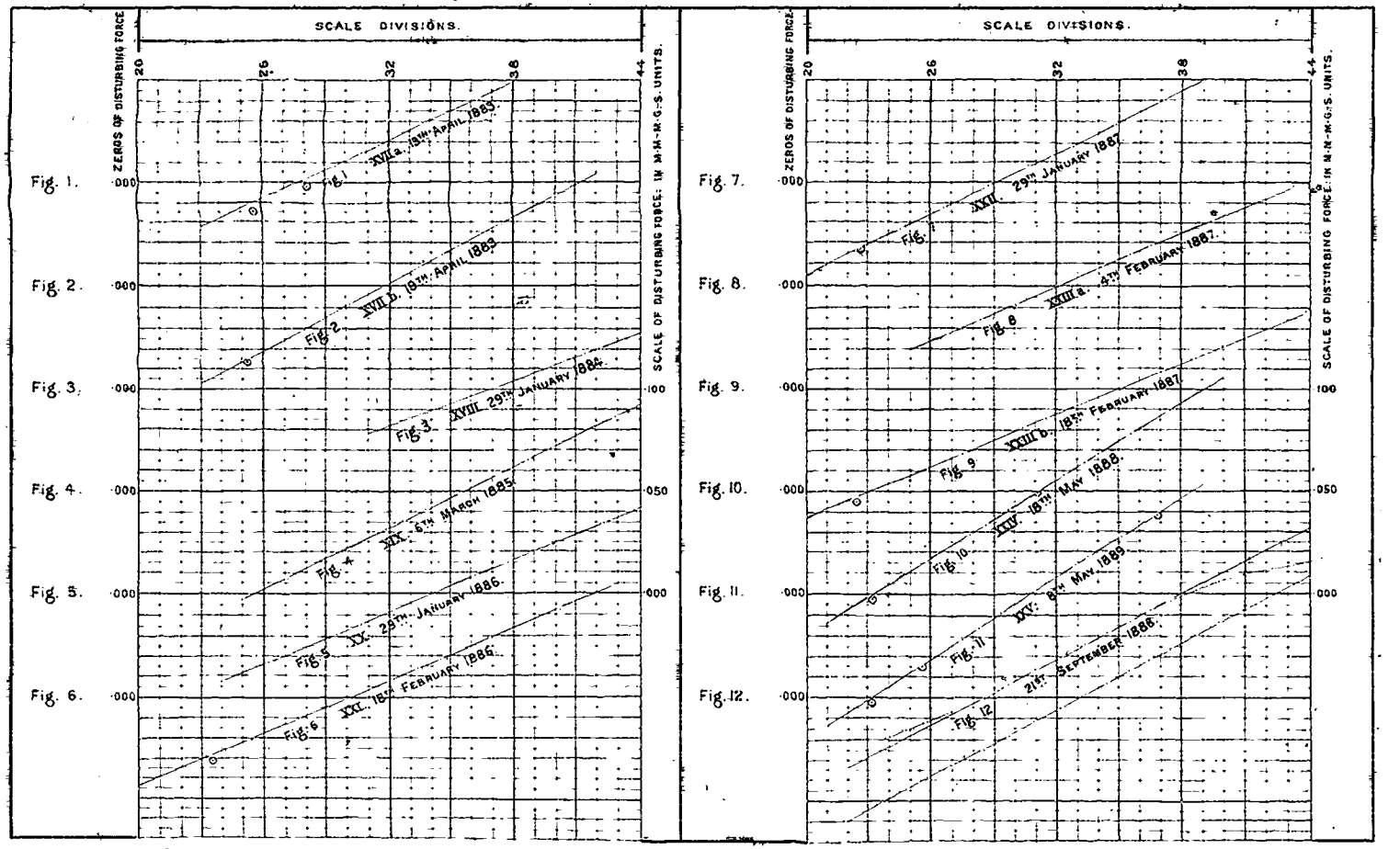
24. In the first place the encircled points at the lower ends of the straight lines are all below the straight lines, and the first thing that suggests itself is that our adopted values of $\frac{W_g}{m}(wo)$ for that part of the scale are numerically too large, and remembering that these values were determined from the data yielded by four experiments only, and that these data varied amongst themselves considerably in that part of the scale (see Appendix I, 1879—82, Figs. 45 to 48, opposite page [37]), there is some ground for admitting the supposition that the values are too large owing to error in the original determinations; but the consideration of Fig. 6 led to a suspicion that the heating experiments at the beginning of 1886 had possibly caused a displacement in the relative positions of the knife-edge and the magnet, so that the scale would thenceforth no longer read 33·2 when the knife-edge rested on the middle of its part of uniform curvature, and to test whether this was the case a special set of deflection experiments was made with scale-readings extending from below 24 to above 44: these deflections, which were observed on the 21st September 1886 and appear at the end of Table 10, are curved in Fig. 12, the ordinates being the disturbing forces of the deflector magnet simply, and the straight line being calculated from the points between 29·71 and 37·50 of the scale. If we now look for symmetry of arrangement of the points about the straight line we shall see, at a glance, that the point near the upper end which corresponds to 23·82 at the lower end is much below 42·58, or that the middle point of the system is below 33·2; and accordingly ordinates were now calculated, in the usual manner but on the assumption that the values of $\frac{W_g}{m}(wo)$ hitherto used for the division 33·2 and related numbers are applicable to the division 31·2 and similarly related numbers and the results of the calculations are shown by the positions of the points along the straight line below Fig. 12, which line is drawn simply to follow the course of the points. The nearness of the points to coincidence with the line at and near its ends implies, so far as one experiment may be trusted, that there has been a shift of position of the knife-edge, and that the deviation of the encircled points at the lower ends of Figs. 1, 6, 7, 9, 10 and 11 are principally due to it; and the sensible deviations of the lower points below the line and of the higher points above it imply further that the original values of $\frac{W_g}{m}(wo)$ were at both ends of the scale numerically too large.

25. It would not, however, be right to attribute the whole of the discrepancies to these causes, and at once to make new determinations of $\frac{W_g}{m}(wo)$ that would remove the discrepancies, because a part of them is undoubtedly due to a fault, that can now be corrected, in the order of succession of the deflections forming a set of experiments. On examining the vertical force magnetograms at times when deflection experiments were in progess, and since the practice was introduced of applying the deflector so gently as to produce no vibration, it is found, as a general rule, that in a series of deflections successively increasing the scale-readings the curves move upward during the short interval between successive deflections, and that in a series of deflections successively decreasing the scale-readings the intervening curves move downward: this is because the magnet takes time to fully assume a new position, hanging back on the side from which it was last disturbed [see Appendix I, 1879—82, Plate IV, Fig. 56 and note (*d*)]; and it may perhaps be assumed—the interval being of nearly the same duration—that a series of deflections all rising or all falling are relatively to each other approximately correct,

COLABA VERTICAL FORCE MAGNETOGRAPH.

SCALE – COEFFICIENTS.

Plate I.



DRAWN & LITHO. GOVT PHOTOZINCO. OFFICE, POONA 1889.

whilst all rising readings are absolulety too low and all falling readings too high. Now it happens naturally that the lowest reading of a set of deflections has always been come down to, either from the position of no disturbance or from some higher reading than itself, and it is thus too high relatively to the readings above it—all of which in some cases, and half of which in others, have been gone up to from lower readings. This partial explanation of the deviations applies to the lowest points of all the Figs. 7, 9, 10 and 11 and in a special manner to the two lowest points of Fig. 1, the upward and downward movement of the intervening bits of curve being in that case very pronounced: it does not apply to Fig. 6, because the deflections, in that instance, were all in series successively decreasing the scale-readings.

26. Apart, however, from opposition of movement in successive deflections, the distance—expressed in scale divisions—of the magnet at its first position of apparent rest from its ultimate goal will, in any case, depend on the intensity of the force that urges it towards the latter position; and this force we know to be much smaller for a given distance at the extremities than near the middle of the scale of the Colába vertical force magnetograph, and, indeed, that at the extreme low and high readings the instrument approaches a state of neutral equilibrium; hence after equal intervals the scale-reading will be further from its ultimate value for low or high readings than for intermediate readings, the difference being an excess or a defect of the high or low scale-readings according as they have been moved down to or moved up to from the next preceding readings. Now the lowest readings of all the Figs. 1, 7, 9 10 and 11 were in fact moved down to, and were thus too large as compared with the respective higher readings. It is true that some of the highest readings that were gone up to should exhibit discrepancies of the contrary sign, placing the corresponding points above the respective straight lines, and there is some slight evidence of this in the highest points of Figs. 8 and 9, though not in those of any of the other figures. In either case the regular record rarely approaches the extreme parts of the scale, and any erratic behaviour of the instrument in those parts is of little practical importance, since it influences but slightly the actual record of any considerable period: in all the months from July 1882 to April 1889, the mean monthly scale-reading lay between 28 and 38, except in March 1883 when it was 27·95, and from January 1 to 17, 1884, when it was 27·00. Of the remaining encircled points the deviation at the point 25·59 of Fig. 11 admits of explanation in the first and second of the four ways just described, and the deviations at the points 31·02 of Fig. 10 and 36·85 of Fig. 11 are scarcely greater than the probable error of an observed position.

27. On the whole, however, and in every case except Fig. 1—and that only at its lower end—the points are remarkably close to the respective straight lines, and the corresponding scale-coefficients for the middle of the scale (33·2) may be accepted with much confidence for the times of the respective experiments. It may be well, nevertheless, not to trust to a mere inspection of the accordance of the several points with the respective straight lines, but to calculate in each case the probable error of the scale-coefficient as yielded by a set of experimental deflections. This was done by first calculating the probable error of a single value of $\left\{ Y+\frac{W_y}{m}(wo) \right\}$ as given in column 5 of Table 10 and from it deducing the required probable error of the scale-coefficient: the first quantity was obtained by inserting in equation (14) the values of $\left(X+\frac{W_y}{m}\sin\epsilon\right)a$ and $(C-Y_1)$ of Table 11 and the scale-readings of column 2 of Table 10 and thereby calculating values of $\left\{ Y+\frac{W_y}{m}(wo) \right\}$, and by then applying the method of least squares to the several differences between the observed and calculated values. Then calling the probable errors of $\left(Y+\frac{W_y}{m}(wo) \right)$ and of the calculated scale-coefficient $\pm e$ and $\pm E$ respectively, and observing that equation (14) is of the form $y=cx+a$ and that there are n such equations from which to determine c and a, we have for equations of condition

$$\Sigma(xy)=c\Sigma x^2+a\Sigma x \text{ and } \Sigma y=c\Sigma x+na \text{ or} \tag{15}$$

$$n\Sigma(xy)=nc\Sigma x^2+na\Sigma x \text{ and } \Sigma x\Sigma y=c\left(\Sigma x\right)^2+na\Sigma x, \text{ whence} - \text{subtracting}$$

$$n\Sigma(xy)-\Sigma x\Sigma y=c\left\{n\Sigma x^2-(\Sigma x)^2\right\} \text{ and}$$

$$c=\frac{n\Sigma(xy)-\Sigma x\Sigma y}{n\Sigma x^2-(\Sigma x)^2} \tag{16}$$

Now the weight of c in equations (15) is $\left\{ \Sigma x^2 - \frac{(\Sigma x)^2}{n} \right\}$, and therefore the probable error of c is $\frac{\pm e}{\sqrt{\left\{ \Sigma x^2 - \frac{(\Sigma x)^2}{n} \right\}}}$ or

$$E = \pm e \frac{\sqrt{n}}{\sqrt{\left\{ n\Sigma x^2 - (\Sigma x)^2 \right\}}} \text{ and} \tag{17}$$

$$\frac{E}{c} = \pm e \frac{\sqrt{\left\{ n\,\Sigma x^2\,\Sigma x^2 - n(\Sigma x)^2 \right\}}}{n\Sigma xy - \Sigma x \Sigma y} \tag{18}$$

By embodying in these expressions the several values of $\left\{ X + \frac{Wg}{m}(wo) \right\}$ afforded by a particular experiment for the typical y, the several values of s for the typical x, and the calculated value of e, we obtain the value for that experiment of $\pm \frac{E}{c}$. This is shown for each experiment in column 9 of Table 11, and the several values of e, calculated in the manner previously mentioned, are shown in column 8 of the same table.

28. On these probable errors, which take no account of any systematic error of the method, it may be remarked that those given by five out of the eleven experiments are less than $\frac{1}{200}$th of the whole scale-coefficient, whilst six are greater ; but of these last the greatest—that of the 13th April 1883—is large, because the number of points that determined the straight line representing the scale-coefficient was in that case small—being five only ; and the next largest value is no greater than $\frac{1}{124}$th of the whole. If we take the mean of the least five values of $\frac{E}{c}$ and the mean of the corresponding five values of the scale-coefficient, we find them to be $\frac{1}{267}$ and ·00528 respectively, and the similar means of the five largest values of $\frac{E}{c}$ (omitting the first) and corresponding values of c are $\frac{1}{154}$ and ·00485 : hence it appears that, $\pm \frac{E}{c}$ being the amount of probable error that attaches to unity of measured disturbance, this error is greater when the scale-coefficient is small and smaller when the last is great : on this account considered by itself alone it would therefore be best to adjust the instrument, so that it should have a large scale-coefficient.

Appendix I, 1879—82, paragraphs 49 and 50.

29. Appendix I, 1879—82, paragraphs 51 to 55. For the reasons stated in Appendix I, 1879—82, paragraph 51, the practice of making deflection observations on a small scale once every month has been continued and has afforded further evidence that the scale-coefficient varies very definitely with the temperature of the vertical force magnetograph and less infallibly with time. The deflector magnet E1 is placed at a constant distance on the north arm only of the deflection ring, and one reading is taken for each of the positions of the deflector—north end down and north end up : the constant distance was 2·5 feet from the 15th July 1882 to the 8th May 1889, except on four occasions when the undisturbed scale-reading was so low that the disturbing force due to that distance would have caused the vertical force magnet to overset : these occasions were the 16th February, 16th March, and 13th April 1883 and the 16th January 1884, when the distances were respectively 2·6, 3·0, 3·0 and 3·0 feet. The data yielded by the monthly experiments and the calculated values of the scale-coefficient, as well as the single deflections (observed generally on the following day)—with the deflector at 1·0 foot distance—of magnet N 23 c in the Kew Unifilar magnetometer are shown in Table 12.

TABLE 12.

[Corresponding to Table 18 of Appendix I, 1879—82.]

Date.	Distance in feet.	Lesser Scale-reading.	Greater Scale-reading.	Double deflection	$\Delta\left\{\frac{Wq}{m}(tw)\right\}$	$2Y+$Col. 6.	$\left(X+\frac{Wq}{m}e\sin\epsilon\right)a$ / Col. 7+Col. 5.	Thermometer of V. F. Magnet :: t	Time reckoned in months from T_0 :: T	Single deflections of Magnet N 23 c by Magnet S 1 at 1·0 foot distance.	Observer.
1	2	3	4	5	6	7	8	9	10	11	12
										° ′ ″	
12th August 1882...	2·5N.	27·49	33·55	6·06	·00295	·03203	·00529	89·4	0·9	6 50 44	P. and V. G. G.
14th September ,, ...	2·5N.	27·34	33·88	6·54	·00317	·03225	·00493	88·6	2·0	6 50 22	P. and G.
16th October ,, }											P. and V. N.
19th October ,, }	*2·5N.	26·84	32·85	6·01	·00394	·03302	·00550	88·8	3·1	6 50 32	P. and G.
15th November ,, ...	2·5N.	25·51	32·48	6·97	·00664	·03572	·00512	87·8	4·1	6 50 45	P. and G.
15th December ,, ...	2·5N.	22·51	31·56	9·05	·01534	·04442	·00491	86·3	5·1	6 50 44	P. and V. G. G.
17th January 1883...	2·5N.	22·65	31·49	8·84	·01484	·04392	·00497	86·8	6·2	6 50 30	P. and G. S. J.
16th February ,, ...	2·6N.	20·50	30·24	9·74	·02313	·04893	·00502	85·8	7·2	6 50 17	P. and G. S. J.
16th March ,, ...	3·0N.	24·42	29·63	5·21	·00867	·02535	·00487	85·9	8·1	6 50 20	P. and V. G. G.
13th April ,, ..	3·0N.	25·60	29·43	3·83	·00559	·02227	·00581	88·2	9·0	6 50 22	P.
19th April 1883...	2·5N.	28·51	34·45	5·94	·00167	·03069	·00517	89·9	0·1	6 50 22	P.
18th May ,, ...	2·5N.	28·35	32·79	4·44	·00184	·03086	·00695	92·0	1·1	6 49 55	P. and V. G. G.
15th June ,, ...	2·5N.	28·40	32·44	4·04	·00179	·03081	·00763	92·5	2·0	6 49 50	P. and K.
18th July ,, ...	2·5N.	28·59	33·90	5·31	·00158	·03060	·00576	90·7	3·1	6 49 32	P. and G.
15th August ,, ...	2·5N.	27·33	32·85	5·52	·00318	·03220	·00583.	89·8	4·0	6 49 2	P. and V. G. G.
24th September ,, ...	2·5N.	26·38	31·92	5·54	·00481	·03379	·00610	88·8	5·3	6 49 45	P. and V. G. G.
23rd October ,, ...	2·5N.	27·23	32·52	5·29	·00333	·03231	·00611	88·9	6·3	6 49 0	P. and G. S. J.
15th November ,, ...	2·5N.	27·31	33·32	6·01	·00321	·03219	·00536	87·7	7·0	6 48 50	P. and V. G. G.
17th December ,, ...	2·5N.	22·49	32·79	10·30	·01546	·04444	·00431	85·0	8·1	6 48 47	P. and G. S. J.
16th January 1884...	3·0N.	23·30	29·54	6·24	·01194	·02856	·00458	83·8	9·0	6 48 17	P. and V. G. G.
29th January 1884...	2·5N.	32·99	42·33	9·34	·00654	·03550	·00380	82·9	0·4	6 48 15	P. and V. G. G.
27th February ,, ...	2·5N.	31·83	38·27	6·44	·00084	·02980	·00463	84·1	1·4	6 48 17	P. and D.
26th March ,, ...	2·5N.	31·30	37·01	5·71	·00021	·02917	·00511	85·8	2·3	6 48 12	P. and D.
26th April ,, ...	2·5N	31·59	36·62	5·03	·00012	·02908	·00578	88·7	3·3	6 48 40	P. and G. S. J.
22nd May ,, ...	2·5N.	31·51	35·73	4·22	·00004	·02900	·00687	91·0	4·2	6 48 32	P. and D.
18th June ,, ..	2·5N.	31·10	35·40	4·30	·00007	·02903	·00675	92·1	5·1	6 47 47	P. and D.
21st July ,, ...	2·5N.	31·12	35·52	4·40	·00007	·02903	·00660	91·3	6·2	6 47 55	P. and G. S. J.
20th August ,, ...	2·5N.	31·60	36·30	4·70	·00007	·02903	·00618	90·0	7·1	6 47 37	P. and D.
18th September ,, ...	2·5N.	31·79	37·09	5·30	·00021	·02917	·00550	88·8	8·1	6 48 5	P. and D.
15th October ,, ...	2·5N.	31·91	36·80	4·89	·00013	·02909	·00595	88·8	9·0	6 47 42	P. and G. S. J.
17th November ,, ...	2·5N.	32·31	37·24	4·93	·00026	·02916	·00591	87·4	10·1	6 47 37	P. and V. G. G.
15th December ,, ...	2·5N.	32·27	37·40	5·13	·00034	·02924	·00570	86·5	11·0	6 47 30	P. and V. G. G.
19th January 1885...	2·5N.	32·82	38·33	5·51	·00087	·02977	·00540	86·2	12·2	6 47 25	P. and D.
19th February ,, ...	2·5N.	32·64	38·39	5·75	·00092	·02982	·00519	85·3	13·2	6 46 50	P. and V. G. G.
6th March ,, ...	2·5N.	32·69	38·80	6·11	·00124	·03014	·00493	86·0	13·7	6 46 42	P. and V. N.
14th April 1885...	2·5N.	32·25	36·54	4·29	·00008	·02898	·00676	88·6	0·0	6 46 17	P. and G. S. J.
19th May ,, ...	2·5N.	31·59	35·21	3·62	·00003	·02893	·00799	91·7	1·2	6 45 25	P. and V. G. G.
19th June ,, ..	2·5N.	30·40	34·40	4·00	·00031	·02903	·00726	93·2	2·2	6 45 27	P. and D.
21st July ,, ...	2·5N.	30·65	34·54	3·89	·00021	·02893	·00744	92·2	3·3	6 44 32	P. and D.
18th August ,, ...	2·5N.	31·22	35·31	4·09	·00006	·02878	·00704	90·6	4·2	6 44 30	P. and G.
18th September,, ...	2·5N.	30·92	35·40	4·48	·00011	·02883	·00644	89·9	5·2	6 44 22	P. and V. N.
16th October ,, ...	2·5N.	31·32	36·01	4·69	·00005	·02877	·00613	89·8	6·1	6 44 15	P. and V. G. G.
17th November 1885.	2·5N.	31·01	35·71	4·70	·00008	·02880	·00613	90·5	0·1	6 43 52	P. and V. G. G.
16th December ,, ...	2·5N.	30·32	35·93	5·61	·00034	·02906	·00518	88·9	1·1	6 43 47	P. and D.
29th January 1886...	2·5N.	30·81	37·60	6·79	·00058	·02930	·00432	86·0	2·5	6 43 57	P. and V. N.
9th February 1886...	2·5N.	27·98	34·87	6·89	·00227	·03087	·00448	86·3	−0·2	6 43 55	P. and V. N.
23rd March ,, ...	2·5N.	26·12	32·39	6·27	·00538	·03398	·00542	88·2	1·2	6 42 40	V. N. and V. G. G.
20th April ,, ...	2·5N.	26·30	31·79	5·49	·00502	·03362	·00612	90·1	2·1	6 42 47	N. N. and V. G. G.
17th May ,, ..	2·5N.	26·38	31·00	4·62	·00481	·03341	·00723	92·7	3·0	6 42 52	P. and V. N.
22nd June ,, ...	2·5N.	26·66	31·24	4·58	·00430	·03290	·00718	92·2	4·2	6 42 45	P. and V. N.
20th July ,, ...	2·5N.	25·71	31·50	5·79	·00624	·03484	·00602	89·9	5·1	6 42 50	P. and V. N.
17th August 1886...	2·5N.	25·20	31·10	5·90	·00739	·03597	·00610	88·9	0·0	6 42 52	P. and V. N.
†21st September ,, ...	2·5N.	25·31	31·10	5·79	·00712	·03570	·00616	89·3	1·2	6 42 47	P. and V. N.
22nd October ,, ...	2·5N.	25·69	31·23	5·54	·00627	·03485	·00629	89·3	2·2	6 42 42	P. and G. S. J.
19th November ,, ...	2·5N.	25·66	31·20	5·54	·00634	·03492	·00630	89·0	3·1	6 42 32	P. and V. N.
20th December ,, ...	2·5N.	24·87	31·09	6·22	·00821	·03679	·00591	88·1	4·1	6 42 17	P. and V. N.
18th January 1887..	2·5N.	24·29	30·90	6·61	·00976	·03834	·00580	87·1	5·1	6 42 2	P. and G. S. J.

* Mean of two deflections.
† Mean of two deflections observed on the same day.

TABLE 12—*continued.*

Date.	Distance in feet.	Lesser Scale-reading.	Greater Scale-reading.	Double deflection	$\Delta\left\{\frac{Mg}{m}(\omega\sigma)\right\}$	$2\,Y+$Col. 6.	$\frac{\left(X+\frac{Mg}{m}c\sin\epsilon\right)a}{\text{Col. 7}\div\text{Col. 5.}}$	Thermometer of V. F. Magnet h t	Time reckoned in months from T_0 T	Single deflections of Magnet N 23 c by Magnet E 1 at 1·0 foot distance.	Observer.
1	2	3	4	5	6	7	8	9	10	11	12
										° ′ ″	
18th February 1887 .	2·5N.	31·60	38·79	7·19	·00127	·02987	·00415	86·2	0·1	6 40 17	P. and D.
18th March ,, ...	2·5N.	31·11	37·30	6·19	·00036	·02902	·00469	87·5	1·1	6 41 7	P. and G. S. J.
15th April ,, ...	2·5N.	31·09	36·52	5·43	·00015	·02881	·00531	89·6	2·0	6 41 15	P. and V. N.
20th May ,, ...	2·5N.	30·80	35·54	4·74	·00016	·02878	·00607	92·2	3·2	6 40 45	P. and V. N.
17th June ,, ...	2·5N.	30·30	35·10	4·80	·00035	·02897	·00604	91·7	4·1	6 40 42	P. and V. N.
19th July ,, ...	2·5N.	30·85	36·15	5·30	·00016	·02880	·00543	89·3	5·2	6 40 55	P. and V. N.
19th August ,, ...	2·5N.	30·24	35·90	5·66	·00037	·02901	·00513	89·1	6·2	6 40 50	P. and V. N.
16th September ,, ...	2·5N.	30·50	36·29	5·79	·00031	·02893	·00500	88·7	7·1	6 40 37	P. and V. N.
19th October ,, ...	2·5N.	30·03	36·01	5·98	·00045	·02899	·00485	88·6	8·2	6 39 22	P. and V. N.
24th November ,, ...	2·5N.	30·60	36·49	5·89	·00030	·02890	·00491	88·0	9·3	6 40 27	P. and V. N.
20th December ,, ...	2·5N.	30·34	36·65	6·31	·00043	·02905	·00460	87·0	10·2	6 40 32	P. and D.
14th January 1888 ...	*2·5N.	29·70	36·35	6·65	·00072	·02932	·00441	86·5	11·0	6 40 19	P. and V. N.
17th January ,, ...											P. and V. N.
20th January 1888 ...	2·5N.	29·50	35·37	5·87	·00082	·02940	·00501	87·5	0·2	6 40 2	P. and V. N.
24th February ,, ...	2·5N.	29·31	35·22	5·91	·00095	·02947	·00499	87·1	1·3	6 39 5	V. N. and V. G. G.
21st March ,, ...	2·5N.	29·28	34·79	5·51	·00097	·02945	·00534	89·4	2·2	6 38 25	V. N. and V. G. G.
24th April ,, ...	2·5N.	28·99	33·95	4·96	·00118	·02966	·00598	91·8	3·3	6 38 30	V. N. and V. G. G.
18th May ,, ...	2·5N.	28·68	33·33	4·65	·00152	·02996	·00644	93·2	4·1	6 38 2	V. N. and V. G. G.
18th June ,, ...	2·5N.	28·78	33·23	4·45	·00141	·02989	·00672	93·9	5·1	6 38 32	V. N. and V. G. G.
17th July ,, ...	2·5N.	28·38	33·32	4·94	·00185	·03033	·00614	91·8	6·1	6 38 37	V. N. and V. G. G.
18th August ,, ...	2·5N.	28·89	33·90	5·01	·00129	·02979	·00595	90·5	7·1	6 38 42	V. N. and V. G. G.
18th September ,, ...	2·5N.	28·50	33·63	5·13	·00172	·03016	·00588	90·3	8·1	6 37 50	V. N. and V. G. G.
17th October ,, ...	2·5N.	28·88	34·13	5·25	·00130	·02978	·00567	90·4	9·1	6 38 25	V. N. and V. G. G.
16th November ,, ...	2·5N.	28·48	33·31	4·83	·00174	·03028	·00627	90·8	10·1	6 39 25	V. N. and V. G. G.
17th December ,, ...	2·5N.	28·56	33·64	5·08	·00165	·03013	·00593	90·2	11·1	6 38 32	V. N. and V. G. G.
17th January 1889 ...	2·5N.	28·68	33·96	5·28	·00152	·03002	·00569	88·9	12·1	6 38 40	V. N. and V. G. G.
18th February ,, ...	2·5N.	29·27	34·88	5·61	·00098	·02948	·00525	88·3	13·1	6 38 47	V. N. and V. G. G.
18th March ,, ...	2·5N.	28·51	33·79	5·28	·00170	·03020	·00572	89·4	14·1	6 38 32	V. N. and V. G. G.
17th April ,, ...	2·5N.	28·58	33·50	4·92	·00163	·03011	·00612	91·3	15·1	6 38 25	V. N. and V. G. G.
8th May ,, ...	2·5N.	28·39	32·89	4·50	·00183	·03025	·00672	92·4	15·8	6 37 32	V. N. and V. G. G.

* Mean of two deflections.

30. Since the 29th January 1886 the monthly deflection observations that were due to be taken at the same time with a large set of deflection experiments have systematically been taken before the commencement of the latter; but on several occasions before that date, *viz.* on the 15th July 1882, 19th April 1883, 29th January 1884 and 6th March 1885, the appropriate numbers were extracted from the large sets of deflections, and it will be seen later (paragraph 35) that they were, for that reason, unsuited for combination with the groups of monthly deflections that, in each case, immediately followed or preceded them. Such groups were formed, first with reference to continuity of action of the instrument, no fresh adjustment of the instrument having been made in the period embraced by a group, and secondly in order that the rate of variation of the scale-coefficient with temperature should be practically uniform throughout the period of a group. Divisions of groups of the first kind, caused by fresh adjustments, occur on the 16th April 1883, 20th January 1884, 1st February 1886 and 31st January 1887, and divisions of the second kind after February and October 1885, after July 1886 and after January 19, 1888; and the former divisions are marked in Table 12 by strong horizontal lines, whilst the latter are marked by thinner lines: for the last division—after January 19, 1888—there is the further reason that the instrument was disturbed by experimentally heating it up to a temperature of over 97° Fahrenheit on the preceding day.

30*a*. The first month for which the photographic registers of the vertical-force magnetograph are complete and satisfactory is that of May 1872, and since the first day of that month the changes of adjustment of the instrument that have been made are the following:—

(1) On the 9th July 1876 the knife-edge of the vertical force magnet and agate plane were cleaned, and the balancing screw was turned.

(2) On the 20th January 1880 the knife-edge of the vertical force magnet and agate plane were cleaned and the balancing screw was turned: a zinc temperature compensation arm was attached, and the two mirrors were cleaned.

(3) On the 27th January 1880 the balancing screw was turned.

(4) On the 11th January 1881 the knife-edge and plane were cleaned : the balancing and sensitising screws were turned : and the balancing weights on the magnet and zinc temperature compensation arm were re-adjusted.

(5) On the 24th January 1881 the balancing screw was turned.

*(6) Between the 27th June and 10th July 1882 the instrument was re-adjusted several times, and several sets of deflection experiments were made upon it: the final adjustment was made on the 10th July by turning the balancing and sensitising screws.

(7) On the 16th April 1883 the balancing screw was turned.

(8) On the 20th January 1884 do. do.

(9) On the 1st February 1886 do. do. , and the knife-edge and plane were cleaned.

(9*a*) On the 4th February 1886 the spider line of the reading telescope was found broken and a new one was inserted : the scale readings taken with the new line under its final adjustment are 0·08 less than those corresponding to the same position of the magnet taken with the old line.

(10) On the 6th February 1886 the balancing screw was turned.

(11) On the 31st January 1887 do. do. , and the knife-edge and plane were cleaned.

(12) On the 12th February 1887 the balancing screw was turned.

31. The data afforded by the groups of monthly deflections, as marked out in Table 12, but omitting the four deflections specified at the beginning of paragraph 30, were now applied, using the method of least squares, to find, for each group, the values of the constants A, b and c in the expression for the scale-coefficient,

$$A+b\,(t-80)+cT, \qquad (19)$$

of Appendix I, 1879—82, paragraph 55. The results of the calculations are shown in Table 13.

TABLE 13.

Group.	Period.	A	b	c	Probable Error.	Probable Error ÷ Scale-coefficient.	Adopted initial time $\bar{T}_{0}$.	
1	2	3	4	5	6	7	8	
							Year.	Month.
III.	August 1882 to April 1883 .	+·00237	+·000296	+·0001099	±·00010	$\pm\frac{1}{52}$	1882	6·5
IV.	May 1883 to January 1884 .	+·00158	+·000423	+·0001060	±·00031	$\pm\frac{1}{19}$	1883	3·5
V.	Feb. 1884 to Feb. 1885 ...	+·00356	+·000257	+·0000219	±·00016	$\pm\frac{1}{36}$	1884	0·5
VI.	April 1885 to October 1885.	+·00486	+·000245	−·0001592	±·00026	$\pm\frac{1}{27}$	1885	3·5
VII.	Nov. 1885 to January 1886*	+·00349	+·000245	−·0002837	±·00014	$\pm\frac{1}{22}$	1885	10·5
VIII.	February 1886 to July 1886.	+·00176	+·000437	−·0000024	±·00006	$\pm\frac{1}{101}$	1886	1·5
IX.	August 1886 to Jan. 1887 .	+·00357	+·000281	+·0000391	±·00006	$\pm\frac{1}{102}$	1886	7·5
X.	Feb. 1887 to January 1888 .	+·00226	+·000316	+·0000078	±·00007	$\pm\frac{1}{72}$	1887	1·5
XI.	January 1888 to May 1889 .	+·00305	+·000252	+·0000238	±·00009	$\pm\frac{1}{68}$	1888	0·5

* This group comprising only three numbers and being badly adapted to give values of both b and c, was used to calculate values of A and c only, the same value of b being adopted for it as was found for the preceding group (VI).

32. All the values of the coefficient b in column 4 have the positive sign, and therefore all concur in indicating that the scale-coefficient increases with increase of temperature. Experimental evidence to the same effect was adduced in Appendix IV to the

* The first half of this statement up to July 1882, ought to have appeared as paragraph 50*a* of Appendix I to the "Bombay Magnetical and Meteorological Observations, 1879—82", but was inadvertently omitted.

"Bombay Magnetical and Meteorological Observations, 1886" where, in paragraph 58, it is explained that most of the periods chosen [in Table 13 above] fail to run through a cycle of temperature changes, and are thus ill-suited for yielding accurate temperature factors, but that they are the best that—in face of general irregularities in the scale-coefficients yielded by the monthly deflections—are available; and that the values they give to the temperature factors are in such accord—although rough—as to leave no doubt of the propriety of taking account of them in the reduction of the vertical force magnetograph registrations.

33. The average of the proportional errors shown in column 7 of Table 13 is $\frac{1}{39}$ and the average scale-coefficient is ·00556; but if we refer to the Appendix I, 1879—82, paragraphs 55 and 63, we shall see that the proportional error of the scale-coefficients derived from the monthly deflections of April 1880 to June 1882 was about $\frac{1}{100}$ and the average scale-coefficient was about ·01 or ·015; so that here again, as in paragraph 28, the amount of error that attaches to unity of measured disturbance is much greater when the sensitiveness of the instrument is increased: on the other hand the element of the vertical magnetic force—the range of the diurnal variation—that it is practically most important to measure exactly has least error when the instrument is most sensitive; for it has an average value of only about ·002, the probable error of a single tabulation of the vertical force magnetograms is about $\pm$·001 inch, and that of the difference between two tabulations near the limits of the diurnal movement of the magnet $\pm$·001 $\times \sqrt{2}$ inch; and as the diurnal range, in inches of tabulation, is $\frac{\cdot 002}{\frac{dy}{da}}$, the proportion of error in the mean of the daily measurements of the diurnal range—repeated for thirty days (or a month) is $\frac{\sqrt{2\times\cdot001}}{\frac{\sqrt{30}}{\cdot002}\frac{dy}{da}}$ $=0{\cdot}13\times\frac{dy}{da}=5{\cdot}43\times0{\cdot}13\times\frac{dy}{da}=\cdot71\frac{dy}{da}$. A value of the diurnal range, expressed in force, is however affected both by error in the adopted value of the scale-coefficient and by error in the measurement of ordinates of the magnetograms, and that one of two degrees of sensitiveness of the instrument is to be preferred which gives the least aggregate error: if the scale-coefficient be ·00556 that aggregate is according to the data given above, $\sqrt{\left\{\left(\frac{1}{39}\right)^2+(\cdot71\times\cdot00556)^2\right\}}=\cdot025943$ or $\frac{1}{39}$; and if it be ·01 or ·015 or (say) ·0125 the aggregate error is $\sqrt{\left\{\left(\frac{1}{100}\right)^2+(\cdot71\times\cdot0125)^2\right\}}=\cdot013370$ or $\frac{1}{75}$*; and the choice between these two scale-coefficients is much in favour of the larger, which gives an aggregate error little more than half as large as the smaller. Hence if accuracy of result be our principal aim, and not merely the convenience of direct appeal to the eye by means of an open scale, there is no question that the more stable adjustment of the Colába instrument has great advantage over the other; and the principal question to be asked, in determining the degree of sensitiveness to be adopted, is not what is *a priori* desirable, but how, having regard to the characteristics of the special instrument, is the greatest accuracy of result to be obtained. No great accuracy is claimed for the numbers expressing the proportional probable errors just given, but they are relatively of a right order of magnitude, and such as fully to bear out the argument here based upon them.

34. Our next step was to calculate with the formula $A+b\,(t-80)+c\,T$ the value of the scale-coefficient for the temperature and time of each of the large deflection experiments, using in a particular case the constants A, b and c of that group in Table 13, the period of which embraces the data of the particular set of large deflection experiments. The results of these calculations and the values of the scale-coefficient given independently by the large deflection experiments are shown side by side in Table 14, as are also the values of the scale-coefficient given by the first or last, or both, of the monthly deflections of each group, the latter being corrected to the mean temperature and time of the corresponding large deflection experiment.

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* If z be the range expressed in force, x the scale-coefficient, and y the range measured in ordinates of the curve,

$$z=x\,y$$

and the square of the probable error of z is equal to

$$\left(\frac{dz}{dx}\right)^2\cdot(\text{p. e. of x})^2+\left(\frac{dz}{dy}\right)^2\cdot(\text{p. e. of y})^2 \text{ or to}$$

$$y^2\,(\text{p. e. of x})^2+x^2\,(\text{p. e. of y})^2$$

and dividing through by z^2 or x^2y^2 and extracting the square root

$$\frac{\text{p. e. of z}}{z}=\sqrt{\left(\frac{\text{p. e. of x}}{x}\right)^2+\left(\frac{\text{p. e. of y}}{y}\right)^2}$$

TABLE 14. *-Showing periods of uninterrupted action of the vertical force magnetograph and comparing scale-coefficients given by the large deflection experiments with those given by the monthly deflections.*

Monthly Deflections.					Large Sets of Deflections.				
	Group.	Date.	Scale co-efficient for division 33·2.	$A+b\,(t-80)+cT$.	Date.	Scale co-efficient for division 33·2.	Column 7 *minus* column 5.	Column 7 *minus* column 5 — Mean.	*A plus* ½(column 9)
1	2	3	4	5	6	7	8	9	10
First ...	III.	15th July 1882 ...	·00421	·00542	14—15th July 1882 ..	·00439	—·00103	—·00106	·00184
Last ..		13th April 1883 ...	·00584	·00582	13th April 1883 ...	·00472	—·00110		
Interrupted on 16th April 1883. Balance of magnet adjusted.									
First ...	IV.	19th April 1883 ...	·00521	·00582	19th April 1883 ...	·00536	—·00046	—·00046	·00135
Interrupted on 20th January 1884. Balance of magnet adjusted.									
First ...	V.	29th January 1884 ...	·00388	·00439	29th January 1884 ...	·00381	—·00058	—·00049	·00332
Last ...		6th March 1885 ..	·00498	·00545	6th March 1885 ...	·00504	—·00041		
	VI.							—·00030	·00471
Last ...	VII.	29th January 1886 ...	·00449	·00442	29th January 1886 ...	·00422	—·00020		·00334
Interrupted on 1st February 1886. Balance of magnet adjusted: magnet and planes cleaned. Also heating experiment made on 30th and 31st January 1886.									
First ...	VIII.	9th February 1886 ...	·00461	·00464	18th February 1886 .	·00431	—·00033	—·00053	·00150
Last ...	IX.	18th January 1887 ...	·00578	·00575	29th January 1887 ...	·00501	—·00074		·00331
Interrupted on 31st January 1887. Balance of magnet adjusted: magnet and planes cleaned.									
First ..	X.	18th February 1887...	·00410	·00438	18th February 1887...	·00424	—·00014	—·00014	·00219
Heating experiment was made on 18th January 1888 with the effect of permanently decreasing the scale-reading.									
Fifth ...	XI.	18th May 1888 ...	·00637	·00663	18th May 1888 ...	·00636	—·00027	—·00020	·00295
Last ...		8th May 1889 ...	·00657	·00665	8th May 1889 ...	·00651	—·00014		

35. Now the numbers in any line of columns 4 and 5 of this table, having been reduced to the time and temperature of that in column 7 of the same line, should agree with each other and with the latter number; but we see that, in fact, the numbers of column 5 are systematically greater than those of column 7, and the numbers of column 4 sometimes agree with those of column 5 and sometimes with those of column 7. For July 15, 1882, April 19, 1883, January 29, 1884 and March 6, 1885, when the monthly deflections were not separately observed, but were extracted from the large sets of deflections of the same respective dates, the numbers in column 4 agree with those of column 7, the data in the former case being identical with part of the data in the latter; whilst all the remaining numbers of column 4 agree with those of column 5, the data for both having been a single upward and a single downward deflection observed on a single day in the one case and on one day in each month in the other. It thus appears that a deflection consisting of a single downward and a single upward movement, taken after the instrument has been undisturbed for a month, is systematically smaller in amount than the deflection

observed when the deflector magnet is at the same distance, and the upward movement is one of a series of upward movements, and the downward movement is one of a series of downward movements, as is the case when the deflection forms one of a long set of experimental deflections. Here again we may call attention to the tendency of the magnet, when disturbed, to hang back towards the side of its goal on which it was last at rest: this tendency is exhibited in a very marked manner in Appendix I, 1879—82, Plate IV, Fig. 56; and remarking that the successive steps of deflection in a long set of deflections may be regarded as causing an equal number of free oscillations of small extent, we see that one of such a set of deflections should be larger in amount than a corresponding single isolated deflection, just in the same way, though in less degree perhaps, as the relative ordinate between the points 6 and 12 of Fig. 56 is larger than the relative ordinate between the points 1 and 7. A suggestion as to the cause of this kind of behaviour of the instrument has been made at the foot of paragraph 59 of Appendix I, 1879—82, but whether this be correct or not, we shall, as in paragragh 63 of Appendix I, 1879—82, adopt a value of A that is a mean of the two independent values given by groups of monthly deflections and by large sets of deflections; and one object of Table 14 is to show the calculation of the mean value of A for each group of monthly deflections: this is done in columns 8 to 10 of the table. It will be observed that the differences in column 9, which are measures of the disagreement of the two methods of determining the scale-coefficient, are generally much larger than the respective probable errors of a determination when the results of each method are dealt with by themselves: the latter numbers are shown in column 8 of Table 11 and in column 6 of Table 13.

Appendix I, 1879-82, paragraphs 56 to 65.

36. Appendix I, 1879—82, paragraph 66. In Table 15 are collected together the adopted values of the constants of equation (19) for the several periods to which they apply :—

TABLE 15.

[Corresponding to Table 20 of Appendix I, 1879—82.]

Period.		Adopted initial time. T_0		Adopted values of constants in equation coefficient$=A+b\,(t-80^\circ)+cT$.		
Beginning.	End.	Year.	Month.	A	b	c
1	2	3	4	5	6	7
11th July 1882 ...	15th April 1883 ...	1882	6·5	+·00184	+·000296	+·0001099
17th April 1883 ...	19th January 1884 .	1883	3·5	+·00135	+·000423	+·0001060
21st January 1884 ...	6th March 1885 ...	1884	0·5	+·00332	+·000257	+·0000219
7th March 1885 ...	16th October 1885 .	1885	3·5	+·00471	+·000245	−·0001592
17th October 1885 ...	29th January 1886 .	1885	10·5	+·00334	+·000245	−·0002837
2nd February 1886...	20th July 1886 ...	1886	1·5	+·00150	+·000437	−·0000024
21st July 1886 ...	30th January 1887 .	1886	7·5	+·00331	+·000281	+·0000391
3rd February 1887...	17th January 1888 .	1887	1·5	+·00219	+·000316	+·0000078
20th January 1888 ...	8th May 1889 ...	1888	0·5	+·00295	+·000252	+·0000238

37. Appendix I, 1879—82, paragraph 67. In order now to find the values of $\frac{dY}{ds}$ for any particular time, temperature, and scale-reading, what we have to do is to calculate, by equation (19) and the proper constants taken from columns 5, 6, and 7 of Table 15, the value of $\left(X + \frac{W_g}{m} c \sin \epsilon\right)a$; and then to calculate the value of $\frac{W_g}{m}(wo)$, by dividing the number interpolated from column 4 of Table 8—corresponding to the particular scale-reading—by the appropriate value of m taken from Table 9: with these two numbers equation (7a) of the Appendix I, 1879—82, page [10] gives

$$\frac{dY}{ds} = \left(X + \frac{W_g}{m} c \sin \epsilon\right)a - \frac{W_g}{m} \frac{\Delta (wo)}{\Delta s}$$

Table 16 exhibits the data for this calculation for each month from July 1882 to April 1889, and the values of $\frac{dY}{ds}$ derived from them, as also the values of $\frac{dY}{di}$, the variation of Y *per* inch of increase of the ordinates of the vertical force magnetograms.

TABLE 16.

Calculation of the scale-coefficients of the Vertical Force Magnetograph for each month from July 1882 to April 1889.

[Corresponding to Table 21 of Appendix I, 1879—82.]

Constants.	Month.	$t-80$	T	$b\,(t-80)$	cT	$A+b(t-80)+cT$	s	$\frac{Wg.}{m}\,\frac{\Delta(\omega)}{\Delta s}$	Column 7 *minus* column 9 $\frac{aY}{ds}$	$\frac{dY}{ds}$
1	2	3	4	5	6	7	8	9	10	11
$A=\cdot00184$; $b=\cdot000296$; Year. Month. $c=\cdot0001099$; $T_0=1882$ 6·5.	July (11th to 31st) 1882.	9·58	0·2	·002836	·000022	·00470	32·52	·00000	·00470	·0255
	August ,,	9·0	1	·002664	·000110	·00461	30·91	·00025	·00436	·0237
	September ,,	8·7	2	·002575	·000220	·00463	30·23	·00046	·00417	·0226
	October ,,	8·8	3	·002605	·000330	·00477	29·80	·00060	·00417	·0226
	November ,,	7·9	4	·002338	·000440	·00462	29·48	·00071	·00391	·0212
	December ,,	6·9	5	·002042	·000549	·00443	28·44	·00108	·00335	·0182
	January 1883 ...	6·7	6	·001983	·000659	·00448	28·12	·00121	·00327	·0178
	February ,, ...	5·8	7	·001717	·000769	·00433	28·04	·00124	·00309	·0168
	March ,, ...	6·0	8	·001776	·000879	·00449	27·95	·00127	·00322	·0175
	April (1st to 15th) 1883.	7·1	8·8	·002102	·000967	·00491	28·27	·00115	·00376	·0204
$A=\cdot00135$; $b=\cdot000423$; Year. Month. $c=\cdot0001060$; $T_0=1883$ 3·5.	April (17th to 30th) 1883.	10·4	0·3	·004399	·000032	·00578	31·16	·00018	·00560	·0304
	May ,,	12·2	1	·005161	·000106	·00662	30·60	·00034	·00628	·0341
	June ,,	12·5	2	·005287	·000212	·00685	30·69	·00031	·00654	·0355
	July ,,	10·7	3	·004526	·000318	·00619	31·09	·00020	·00599	·0325
	August ,,	9·8	4	·004145	·000424	·00592	30·19	·00047	·00545	·0296
	September ,,	8·9	5	·003765	·000530	·00564	29·52	·00069	·00495	·0269
	October ,,	8·8	6	·003722	·000636	·00571	29·95	·00055	·00516	·0280
	November ,,	7·5	7	·003172	·000742	·00526	30·35	·00042	·00484	·0263
	December ,,	5·1	8	·002157	·000848	·00435	28·74	·00097	·00338	·0184
	January (1st to 17th) 1884.	3·80	8·8	·001607	·000933	·00389	27·00	·00165	·00224	·0122
	January (18th and 19th) 1884.	3·23	9·1	·001366	·000965	·00368	36·14	·00010	·00358	·0194
$A=\cdot00332$; $b=\cdot000257$; $c=\cdot0000219$; Year. Month. $T_0=1884$ 0·5	January (21st to 31st) 1884.	3·19	0·3	·000820	·000007	·00415	37·67	·00051	·00364	·0198
	February ,,	3·4	1	·000874	·000022	·00422	35·62	·00002	·00420	·0228
	March ,,	5·2	2	·001336	·000044	·00470	34·37	·00000	·00470	·0255
	April ,,	7·5	3	·001927	·000066	·00531	33·91	·00000	·00531	·0288
	May ,,	10·31	4	·002650	·000088	·00606	33·60	·00000	·00606	·0329
	June ,,	11·88	5	·003053	·000109	·00648	33·19	·00000	·00648	·0352
	July ,,	11·14	6	·002863	·000131	·00631	33·58	·00000	·00631	·0343
	August ,,	9·97	7	·002562	·000153	·00603	33·94	·00000	·00603	·0327
	September ,,	9·24	8	·002375	·000175	·00587	34·18	·00000	·00587	·0319
	October ,,	8·70	9	·002236	·000197	·00575	34·42	·00000	·00575	·0312
	November ,,	7·59	10	·001951	·000219	·00549	34·61	·00000	·00549	·0298
	December ,,	6·69	11	·001719	·000241	·00528	34·79	·00000	·00528	·0287
	January 1885.	6·38	12	·001640	·000263	·00522	35·07	·00000	·00522	·0283
	February ,,	5·60	13	·001439	·000285	·00504	35·61	·00002	·00502	·0273
	March (1st to 6th) ,,	5·86	13·6	·001506	·000298	·00512	35·37	·00000	·00512	·0278
$A=\cdot00471$; $b=\cdot000245$; Year. M. $c=-\cdot0001592$; $T_0=1885$ 3·5	March (7th to 31st) 1885	6·89	—·9	·001688	·000143	·00654	34·74	·00000	·00654	·0355
	April ,,	8·88	0	·002176	·000000	·00689	34·25	·00000	·00689	·0374
	May ,,	11·39	1	·002791	—·000159	·00734	33·43	·00000	·00734	·0399
	June ,,	12·99	2	·003183	—·000318	·00757	32·75	·00000	·00757	·0411
	July ,,	12·25	3	·003001	—·000478	·00723	32·71	·00000	·00723	·0393
	August ,,	10·54	4	·002582	—·000637	·00665	33·24	·00000	·00665	·0361
	September ,,	9·59	5	·002350	—·000796	·00626	33·45	·00000	·00626	·0340
	October (1st to 16th) ,,	9·68	5·8	·002372	—·000923	·00616	33·62	·00000	·00616	·0334

TABLE 16—*continued.*

Constants.	Month.	$t-80$	T	$b(t-80)$	cT	$A+b(t-80)+cT$	s	$\frac{Wy.}{m}\ \frac{\Delta(100)}{\Delta s}$	Column 7 *minus* column 9 / $\frac{dY}{ds}$	$\frac{dY}{di}$
1	2	3	4	5	6	7	8	9	10	11
$A=\cdot00334$; $b=\cdot000245$; Year. Month. $T_0=1885$ 10·5; $c=-\cdot0002837$; $T_0=1885$ 10·5	October (17th to 31st) 1885.	9·95	−0·7	·002438	·000199	·00598	33·62	·00000	·00598	·0325
	November „	10·10	0	·002474	·000000	·00581	33·46	·00000	·00581	·0315
	December „	8·88	1	·002176	−·000284	·00523	33·24	·00000	·00523	·0284
	January (1st to 29th) 1886.	7·55	2	·001850	−·000567	·00462	33·49	·00000	·00462	·0251
$A=\cdot00150$; $b=\cdot000437$; $c=-\cdot0000024$; Year. Month. $T_0=1886$ 1·5.	February (2nd to 5th) 1886.	7·32	−0·4	·003199	·000001	·00470	32·21	·00002	·00468	·0254
	February (7th to 28th) 1886.	6·47	0·1	·002827	·000000	·00433	30·40	·00041	·00392	·0213
	March „	7·77	1	·003395	−·000002	·00489	29·40	·00074	·00415	·0225
	April „	9·64	2	·004213	−·000005	·00571	29·20	·00081	·00490	·0266
	May „	12·53	3	·005476	−·000007	·00697	28·91	·00092	·00605	·0329
	June „	12·76	4	·005576	−·000010	·00707	28·88	·00094	·00613	·0333
	July 1st to 20th „	10·28	4·8	·004492	−·000012	·00598	29·10	·00085	·00513	·0279
$A=\cdot00331$; $b=\cdot000281$; Year. M. $T_0=1886$ 7·5; $c=\cdot0000391$; $T_0=1886$ 7·5	July (21st to 31st) 1886.	9·25	−0·6	·002599	−·000023	·00589	28·74	·00099	·00490	·0266
	August „	8·82	0	·002478	·000000	·00579	28·52	·00107	·00472	·0256
	September „	8·68	1	·002439	·000039	·00579	28·53	·00107	·00472	·0256
	October „	8·98	2	·002523	·000078	·00591	28·66	·00102	·00489	·0266
	November „	8·79	3	·002470	·000117	·00590	28·75	·00099	·00491	·0267
	December „	8·02	4	·002254	·000156	·00572	28·50	·00108	·00464	·0252
	January (1st to 30th) 1887.	6·97	5	·001959	·000195	·00546	28·23	·00119	·00427	·0232
$A=\cdot00219$; $b=\cdot000316$; $c=\cdot0000078$; Year. Month. $T_0=1887$ 1·5.	February (3rd to 10th) 1887.	6·15	−0·3	·001943	−·000002	·00413	31·59	·00007	·00406	·0220
	February (13th to 28th) 1887.	6·36	0·2	·002010	·000002	·00420	34·90	·00000	·00420	·0228
	March „	7·48	1	·002364	·000008	·00456	34·04	·00000	·00456	·0248
	April „	9·52	2	·003008	·000016	·00521	33·56	·00000	·00521	·0283
	May „	11·89	3	·003757	·000023	·00597	33·01	·00000	·00597	·0324
	June „	11·90	4	·003760	·000031	·00598	32·62	·00000	·00598	·0325
	July „	9·58	5	·003027	·000039	·00526	33·14	·00000	·00526	·0286
	August „	8·77	6	·002771	·000047	·00501	33·28	·00000	·00501	·0272
	September „	8·10	7	·002560	·000055	·00480	33·38	·00000	·00480	·0261
	October „	8·01	8	·002531	·000062	·00478	33·27	·00000	·00478	·0260
	November „	7·85	9	·002481	·000070	·00474	33·21	·00000	·00474	·0257
	December „	6·64	10	·002098	·000078	·00437	33·42	·00000	·00437	·0237
	January (1st to 17th) 1888.	6·46	10·8	·002041	·000084	·00431	33·20	·00000	·00431	·0234

TABLE 16—*continued.*

Constants.	Month.		$t-80$	T	$b(t-80)$	cT	$A+b(t-80)+cT$	S	$\frac{Wg}{m}\frac{\Delta(wo)}{\Delta s.}$	Column 7 *minus* column 9 $\frac{dY}{ds}$	$\frac{dY}{di.}$
1	2		3	4	5	6	7	8	9	10	11
$A=.00295$; $b=.000252$; $c=.000238$; Year, Month. $T_0=1888$ 0·5.	January (20th to 31st)	1888.	6·73	0·3	·001696	·000007	·00465	32·65	·00000	·00465	·0252
	February	,,	6·66	1	·001678	·000024	·00465	32·74	·00000	·00465	·0252
	March	,,	8·66	2	·002182	·000048	·00518	32·28	·00002	·00516	·0280
	April	,,	11·04	3	·002782	·000071	·00580	31·75	·00006	·00574	·0312
	May	,,	12·81	4	·003228	·000095	·00627	31·26	·00015	·00612	·0332
	June	,,	13·54	5	·003412	·000119	·00648	30·98	·00024	·00624	·0339
	July	,,	11·87	6	·002991	·000143	·00608	31·10	·00020	·00588	·0319
	August	,,	10·40	7	·002621	·000167	·00574	31·48	·00009	·00565	·0307
	September	,,	10·11	8	·002548	·000190	·00569	31·43	·00010	·00559	·0304
	October	,,	10·56	9	·002661	·000214	·00582	31·67	·00007	·00575	·0312
	November	,,	10·93	10	·002754	·000238	·00594	31·09	·00020	·00574	·0312
	December	,,	10·16	11	·002560	·000262	·00577	31·53	·00008	·00569	·0309
	January	1889.	8·99	12	·002265	·000286	·00550	31·58	·00007	·00543	·0295
	February	,,	8·51	13	·002145	·000309	·00540	31·78	·00006	·00534	·0290
	March	,,	9·61	14	·022422	·000333	·00570	31·48	·00009	·00561	·0305
	April	,,	10·92	15	·002752	·000357	·00606	31·20	·00017	·00589	·0320

38. Appendix I, 1879—82, paragraph 58 (foot-note). Indications of vacuum gauge at beginning and end of periods during which the air in the enclosure of the vertical force magnetograph was under artificial pressure were as follows :—

Beginning of Period.	Pressure.	End of Period.	Pressure.
	Inches of Mercury.		Inches of Mercury.
July 17, 1882	2·26	April 16, 1883	2·34
April 16, 1883	1·55	December 4, 1883	1·32
December 5, 1883	1·33	January 20, 1884	1·35
January 20, 1884	1·45	May 25, 1884	1·40
May 26, 1884	1·41	January 30, 1886	1·82
February 1 ,1886	1·86	February 6, 1886	1·86
Do. 6, 1886	1·56	January 31, 1887	1·64
Do. 3, 1887	1·61	February 7, 1887	1·59
Do. 15, 1887	1·94	May 3, 1887	1·93
May 4, 1887	1·94	April 30, 1889	2·27

Appendix I, 1879—82, paragraphs 68 to 72.

TEMPERATURE-COEFFICIENT OF THE VERTICAL FORCE MAGNETOGRAPH.

39. Appendix I, 1879—82, paragraphs 73 to 86. See also Appendix V to the Bombay Magnetical and Meteorological Observations, 1886, paragraphs 59 to 62. It may be mentioned, with reference to paragraph 61, that a second vertical force magnetograph is being procured, and will be erected in the Colába magnetograph room alongside of the other. [September 1889.]

SCALE-COEFFICIENT OF THE HORIZONTAL FORCE MAGNETOGRAPH.

40. Appendix I, 1879—82, paragraphs 87 to 89.

TABLE 17.—*Experimental deflections of the Magnet N 3, suspended in the Electrometer Tower, by the deflector Magnet E 1.*

OBSERVATIONS.

[Corresponding to Table 25 of Appendix I, 1879—82.]

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
XIII.—13th July 1882.	d. h. m.					P. and K.
	13 19 19	14·05	82·4	Away.	...	
	,, ,, 23	15·14	...	3·0 E.	E.	
	,, ,, 27	13·04	...	3·0 E.	W.	
	,, ,, 31	14·07	...	Away.	...	
	,, ,, 36	13·06	...	3·0 W.	W.	
	,, ,, 41	15·13	...	3·0 W.	E.	
	,, ,, 46	14·07	82·4	Away.	...	
	,, ,, 51	15·90	...	2·5 W.	E.	
	,, ,, 56	12·32	...	2·5 W.	W.	
	,, 20 1	14·09	...	Away.	...	
	,, ,, 6	12·28	...	2·5 E.	W.	
	,, ,, 10	15·91	...	2·5 E.	E.	
	,, ,, 14	14·08	82·5	Away.	...	
	,, ,, 18	16·73	...	2·2 E.	E.	
	,, ,, 21	11·44	...	2·2 E.	W.	
	,, ,, 25	14·10	...	Away.	...	
	,, ,, 29	11·50	...	2·2 W.	W.	
	,, ,, 33	16·71	...	2·2 W.	E.	
	,, ,, 36	14·10	82·6	Away.	...	
	,, ,, 40	17·58	...	2·0 W.	E.	
	,, ,, 44	10·61	...	2·0 W.	W.	
	,, ,, 47	14·10	...	Away.	...	
	,, ,, 51	10·58	...	2·0 E.	W.	
	,, ,, 55	17·60	...	2·0 E.	E.	
	,, ,, 59	14·09	82 7	Away.	...	
XIV.—14th August 1883.	14 19 13	14·15	87·0	Away.	...	P. and V. G. G.
	,, ,, 18	15·24	...	3·0 E.	E.	
	,, ,, 29	13·13	...	3·0 E.	W.	
	,, ,, 44	14·15	...	Away.	...	
	,, ,, 50	13·14	...	3·0 W.	W.	
	,, ,, 55	15·23	...	3·0 W.	E.	
	,, 20 1	14·16	86·7	Away.	...	
	,, ,, 6	15·98	...	2·5 W.	E.	
	,, ,, 11	12·40	...	2·5 W.	W.	
	,, ,, 16	14·17	...	Away.	...	
	,, ,, 21	12·41	...	2·5 E.	W.	
	,, ,, 26	15·98	...	2·5 E.	E.	
	,, ,, 31	14·19	86·4	Away.	...	
	,, ,, 36	16·78	...	2·2 E.	E.	
	,, ,, 43	11·59	...	2·2 E.	W.	
	,, ,, 49	14·19	...	Away.	...	
	,, ,, 55	11·60	...	2·2 W.	W.	
	,, 21 0	16·79	..	2·2 W.	E.	
	,, ,, 5	14·17	86·2	Away.	...	
	,, ,, 10	17·67	...	2·0 W.	E.	
	,, ,, 15	10·70	...	2·0 W	W.	
	,, ,, 19	14·18	...	Away.	...	
	,, ,, 25	10·75	...	2·0 E.	W.	
	,, ,, 30	17·65	...	2·0 E.	E.	
	,, ,, 35	14·20	86·0	Away.	...	
XV.—23rd September 1884.	23 20 2	14·07	82·4	Away.	...	P. and D.
	,, ,, 7	15·10	...	3·0 E.	E.	
	,, ,, 11	13·04	...	3·0 E.	W.	
	,, ,, 15	14·07	...	Away.	...	
	,, ,, 19	13·04	...	3·0 W.	W.	
	,, ,, 23	15·10	...	3·0 W.	E.	
	,, ,, 29	14·07	82·4	Away.	...	
	,, ,, 33	15·85	...	2·5 W.	E.	
	,, ,, 37	12·31	...	2·5 W.	W.	
	,, ,, 41	14·08	...	Away.	...	

Number and date of Experiment.	Local Time.	Scale Reading	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
XV.—23rd September 1884—*continued.*	d .h. m.					P. and D.
	23 20 45	12·30	...	2·5 E.	W.	
	,, ,, 49	15·84	...	2·5 E.	E.	
	,, ,, 54	14·06	82·5	Away.	...	
	,, ,, 58	11·53	...	2·2 E.	E.	
	,, 21 2	16·64	...	2·2 E.	W.	
	,, ,, 5	14·06	...	Away.	...	
	,, ,, 9	11·50	...	2·2 W.	W.	
	,, ,, 13	16·66	...	2·2 W.	E.	
	,, ,, 18	14·07	82·5	Away.	...	
	,, ,, 21	17·53	...	2·0 W.	E.	
	,, ,, 25	10·64	...	2·0 W.	W.	
	,, ,, 28	14·06	...	Away.	...	
	,, ,, 31	10·63	...	2·0 E.	W.	
	,, ,, 34	17·48	...	2·0 E.	E.	
	,, ,, 38	14·06	82·5	Away.	...	
XVI.—23rd December 1884.	23 19 26	13·94	80·8	Away.	...	P. and G. S. J.
	,, ,, 31	14·97	...	3·0 E.	E.	
	,, ,, 35	12·91	...	3·0 E.	W.	
	,, ,, 39	13·95	...	Away.	...	
	,, ,, 44	12·92	...	3·0 W.	W.	
	,, ,, 49	14·99	...	3·0 W.	E.	
	,, ,, 55	13·96	80·7	Away.	...	
	,, ,, 59	15·76	...	2·5 W.	E.	
	,, 20 4	12·20	...	2·5 W.	W.	
	,, ,, 8	13·96	...	Away.	...	
	,, ,, 12	12·20	...	2·5 E.	W.	
	,, ,, 16	15·74	...	2·5 E.	E.	
	,, ,, 21	13·96	80·5	Away.	...	
	,, ,, 25	16·53	...	2·2 E.	E.	
	,, ,, 29	11·43	...	2·2 E.	W.	
	,, ,, 33	13·95	...	Away.	...	
	,, ,, 37	11·38	...	2·2 W.	W.	
	,, ,, 41	16·59	...	2·2 W.	E.	
	,, ,, 46	13·95	80·2	Away.	...	
	,, ,, 50	17·45	...	2·0 W.	E.	
	,, ,, 54	10·50	...	2·0 W.	W.	
	,, ,, 58	13·97	...	Away.	...	
	,, 21 2	10·54	...	2·0 E.	W.	
	,, ,, 6	17·36	...	2·0 E.	E.	
	,, ,, 12	13·97	80·0	Away.	...	
XVII.—16th January 1885.	16 19 12	13·97	80·4	Away	...	P. and D.
	,, ,, 17	14·97	...	3·0 E	E.	
	,, ,, 21	12·95	...	3·0 E	W.	
	,, ,, 25	13·98	...	Away	...	
	,, ,, 29	12·93	...	3·0 W	W.	
	,, ,, 33	15·03	...	3·0 W	E.	
	,, ,, 39	13·95	80·2	Away	...	
	,, ,, 43	15·75	...	2·5 W	E.	
	,, ,, 47	12·17	...	2·5 W	W.	
	,, ,, 51	13·97	...	Away.	...	
	,, ,, 55	12·18	...	2·5 E.	W.	
	,, ,, 59	15·76	...	2·5 E.	E.	
	,, 20 5	13·95	79·9	Away.	...	
	,, ,, 9	16·51	...	2·2 E.	E.	
	,, ,, 13	11·39	...	2·2 E.	W.	
	,, ,, 17	13·96	...	Away.	...	
	,, ,, 21	11·34	...	2·2 W.	W.	
	,, ,, 25	16·57	...	2·2 W.	E.	
	,, ,, 31	13·95	79·7	Away.	...	
	,, ,, 35	17·47	...	2·0 W.	E.	

TABLE 17—*continued.*

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North-end.	Observer.
	d. h. m.					
XVII.—16th January 1885 —*continued.*	16 19 39	10·48	...	2·0 W.	W.	P. and D.
	,, ,, 43	13·95	...	Away.	...	
	,, ,, 47	10·52	...	2·0 E.	W.	
	,, ,, 51	17·35	...	2·0 E.	E.	
	,, ,, 58	13·94	79·6	Away.	...	
XVIII.—25th February 1886.	25 19 45	14·22	84·8	Away.	...	V. N. and P.
	,, ,, 50	15·24	...	3·0 E.	E.	
	,, ,, 53	13·19	...	3·0 E.	W.	
	,, ,, 56	14·22	...	Away.	...	
	,, ,, 59	13·20	...	3·0 W.	W.	
	,, 20 3	15·27	...	3·0 W.	E.	
	,, ,, 7	14·24	84·8	Away.	...	
	,, ,, 10	16·00	...	2·5 W.	E.	
	,, ,, 13	12·50	...	2·5 W.	W.	
	,, ,, 15	14·20	...	Away.	...	
	,, ,, 17	12·51	...	2·5 E.	W.	
	,, ,, 20	15·98	...	2·5 E.	E.	
	,, ,, 24	14·20	84·7	Away.	...	
	,, ,, 27	16·78	...	2·2 E.	E.	
	,, ,, 30	11·67	...	2·2 E.	W.	
	,, ,, 32	14·20	...	Away.	...	
	,, ,, 34	11·66	...	2·2 W.	W.	
	,, ,, 36	16·79	...	2·2 W.	E.	
	,, ,, 39	14·19	84·6	Away.	...	
	,, ,, 42	17·64	...	2·0 W.	E.	
	,, ,, 45	10·79	...	2·0 W.	W.	
	,, ,, 48	14·19	...	Away.	...	
	,, ,, 51	10·80	...	2·0 E.	W.	
	,, ,, 54	17·62	...	2.0 E.	E.	
	,, ,, 58	14·18	84·6	Away.	...	
XIX.—12th May 1887.	12 21 42	14·03	88·8	Away.	...	V. N. and P.
	,, ,, 45	15·04	...	3·0 E.	E.	
	,, ,, 48	13·02	...	3·0 E.	W.	
	,, ,, 51	14·03	...	Away.	...	
	,, ,, 55	13·00	...	3·0 W.	W.	
	,, ,, 59	15·05	...	3·0 W.	E.	
	,, 22 3	14·03	88·4	Away.	...	
	,, ,, 6	15·80	...	2·5 W.	E.	
	,, ,, 9	12·32	...	2·5 W.	W.	
	,, ,, 11	14·01	...	Away.	...	
	,, ,, 13	12·34	...	2·5 E.	W.	
	,, ,, 15	15·75	...	2·5 E.	E.	
	,, ,, 17	14·02	88·1	Away.	...	
	,, ,, 19	16·54	...	2·2 E.	E.	
	,, ,, 22	11·54	...	2·2 E.	W.	
	,, ,, 25	14·03	...	Away.	...	
	,, ,, 28	11·48	...	2·2 W.	W.	
	,, ,, 30	16·61	...	2·2 W.	E.	
	,, ,, 33	14·01	88·1	Away.	...	
	,, ,, 36	17·48	...	2·0 W.	E.	
	,, ,, 39	10·63	...	2·0 W.	W.	
	,, ,, 41	14·04	...	Away.	...	
	,, ,, 43	10·71	...	2·0 E.	W.	
	,, ,, 46	17·38	...	2·0 E.	E.	
	,, ,, 48	14·02	88·0	Away.	...	
	,, ,, 53	27·33	...	1·25 E.	E.	
	,, ,, 56	0·66	...	1·25 E.	W.	
	,, ,, 58	14·02	...	Away.	...	
	,, 23 3	0·21	...	1·25 W.	W.	
	,, ,, 8	27·91	...	1·25 W.	E.	
	,, ,, 11	14·01	87·8	Away.	...	
XX.—31st May 1888.	31 20 53	13·94	90·8	Away.	...	V. N. and V. G. G.
	,, 21 9	14·92	...	3·0 E.	E.	
	,, ,, 16	12·87	...	3·0 E.	W.	
	,, ,, 18	13·90	...	Away.	...	
	,, ,, 22	12·89	...	3·0 W.	W.	

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North-end.	Observer.
	d. h. m.					
XX.—31st May 1888—*continued.*	31 21 25	14·95	...	3·0 W.	E.	V. N. and V. G. G.
	,, ,, 31	13·92	89·9	Away.	...	
	,, ,, 37	15·69	...	2·5 W.	E.	
	,, ,, 40	12·20	...	2·5 W.	W.	
	,, ,, 42	13·90	...	Away.	...	
	,, ,, 45	12·20	...	2·5 E.	W.	
	,, ,, 49	15·68	...	2·5 E.	E.	
	,, ,, 52	13·92	89·8	Away.	...	
	,, ,, 55	16·46	...	2·2 E.	E.	
	,, ,, 58	11·39	...	2·2 E.	W.	
	,, 22 1	13·91	...	Away.	...	
	,, ,, 5	11·36	...	2·2 W.	W.	
	,, ,, 9	16·51	...	2·2 W.	E.	
	,, ,, 15	13·92	90·1	Away.	...	
	,, ,, 21	17·35	...	2·0 W.	E.	
	,, ,, 25	10·50	...	2·0 W.	W.	
	,, ,, 28	13·89	...	Away.	...	
	,, ,, 32	10·51	...	2·0 E.	W.	
	,, ,, 37	17·28	...	2·0 E.	E.	
	,, ,, 40	13·89	89·9	Away.	...	
	,, ,, 43	27·36	...	1·25 E.	E.	
	,, ,, 50	0·35	...	1·25 E.	W.	
	,, ,, 53	13·90	...	Away.	...	
	,, ,, 56	0·20	...	1·25 W.	W.	
	,, 23 3	27·73	...	1·25 W.	E.	
	,, ,, 10	13·90	89·8	Away.	...	
XXI.—4th June 1888.	4 20 28	14·05	91·0	Away.	...	V. N. and V. G. G.
	,, ,, 33	15·07	...	3·0 E.	E.	
	,, ,, 37	13·03	...	3·0 E.	W.	
	,, ,, 39	14·04	...	Away.	...	
	,, ,, 42	13·03	...	3·0 W.	W.	
	,, ,, 45	15·06	...	3·0 W.	E.	
	,, ,, 50	14·05	90·8	Away.	...	
	,, ,, 54	15·79	...	2·5 W.	E.	
	,, ,, 58	12·37	...	2·5 W.	W.	
	,, 21 0	14·04	...	Away.	...	
	,, ,, 4	12·34	...	2·5 E.	W.	
	,, ,, 7	15·80	...	2·5 E.	E.	
	,, ,, 12	14·04	90·2	Away.	...	
	,, ,, 17	16·61	...	2·2 E.	E.	
	,, ,, 22	11·50	...	2·2 E.	W.	
	,, ,, 25	14·05	...	Away.	...	
	,, ,, 28	11·53	...	2·2 W.	W.	
	,, ,, 32	16·59	...	2·2 W.	E.	
	,, ,, 38	14·04	89·9	Away.	...	
	,, ,, 44	17·41	...	2·0 W.	E.	
	,, ,, 48	10·68	...	2·0 W.	W.	
	,, ,, 56	14·02	...	Away.	...	
	,, 22 1	10·65	...	2·0 E.	W.	
	,, ,, 6	17·48	...	2·0 E.	E.	
	,, ,, 13	14·06	89·8	Away.	...	
	,, ,, 18	27·79	...	1·25 E.	E.	
	,, ,, 23	0·30	...	1·25 E.	W.	
	,, ,, 27	14·05	...	Away.	...	
	,, ,, 32	0·55	...	1·25 W.	W.	
	,, ,, 36	27·65	...	1·25 W.	E.	
	,, ,, 41	14·08	89·8	Away.	...	
XXII.—7th May 1889.	7 21 38	14·05	90·5	Away.	...	V. N. and V. G. G.
	,, ,, 45	15·06	...	3·0 E.	E.	
	,, ,, 48	13·04	...	3·0 E.	W.	
	,, ,, 50	14·05	...	Away.	...	
	,, ,, 54	13·02	...	3·0 W.	W.	
	,, ,, 56	15·09	...	3·0 W.	E.	
	,, ,, 59	14·05	90·3	Away.	...	
	,, 22 3	15·82	...	2·5 W.	E.	
	,, ,, 5	12·33	...	2·5 W.	W.	

TABLE 17—*continued.*

Number and date of Experiment.	Local Time.	Scale Reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North-end.	Observer.
XXII.—7th May 1889—*continued.*	d. h. m.					V. N. and V. G. G.
	7 22 7	14·05	...	Away.	...	
	„ „ 11	12·37	...	2·5 E.	W.	
	„ „ 15	15·78	...	2·5 E.	E.	
	„ „ 18	14·04	90·0	Away.	...	
	„ „ 21	16·56	...	2·2 E.	E.	
	„ „ 24	11·57	...	2·2 E.	W.	
	„ „ 25	14·05	...	Away.	...	
	„ „ 29	11·49	...	2·2 W.	W.	
	„ „ 32	16·65	...	2·2 W.	E.	
	„ „ 35	14·05	89·9	Away.	...	
	„ „ 38	17·51	...	2·0 W.	E.	
XXII.—7th May 1889—*continued.*	d. h. m.					V. N. and V. G. G.
	7 22 41	10·63	...	2·0 W.	W.	
	„ „ 43	14·04	...	Away.	...	
	„ „ 46	10·75	...	2·0 E.	W.	
	„ „ 48	17·38	...	2·0 E.	E.	
	„ „ 51	14·05	89·9	Away.	...	
	„ 23 13	27·20	...	1·25 E.	E.	
	„ „ 22	0·86	...	1·25 E.	W.	
	„ „ 25	14·05	...	Away.	...	
	„ „ 31	0·07	...	1·25 W.	W.	
	„ „ 36	*28·07	...	1·25 W.	E.	
	„ „ 40	14·05	89·8	Away.	...	

* The scale extending only to the division 28, this number was obtained by estimation of the excess above 28.

TABLE 18.—*Experimental deflections of the Magnet N 3, suspended in the Electrometer Tower, by the deflector Magnet E 1.*

CALCULATION, FROM THE DATA IN TABLE 17, OF THE DOUBLE DEFLECTIONS.

[Corresponding to Table 26 of Appendix I, 1879—82.]

Number and date of Experiment.	Distance.	Means. Higher Reading.	Means. Lower Reading.	Difference or double deflection.	Double Deflection. Corrected for crack in Scale.	Double Deflection. Corrected for torsion.	Value of one division of Scale.
XIII.—13th July 1882.	3·0	15·14	13·05	2·09	2·09	2·09	14″·30
	2·5	15·91	12·30	3·61	3·64	3·64	—
	2·2	16·72	11·47	5·25	5·28	5·28	...
	2·0	17·59	10·60	6·99	7·02	7·03	...
XIV.—14th August 1883.	3·0	15·23	13·13	2·10	2·10	2·10	14″·30
	2·5	15·98	12·41	3·57	3·60	3·60	...
	2·2	16·79	11·60	5·19	5·22	5·22	...
	2·0	17·66	10·72	6·94	6·97	6·98	..
XV.—23rd September 1884.	3·0	15·10	13·04	2·06	2·06	2·06	14″·34
	2·5	15·84	12·31	3·53	3·56	3·56	...
	2·2	16·65	11·52	5·13	5·16	5·17	...
	2·0	17·51	10·64	6·87	6·90	6·91	...
XVI.—23rd December 1884.	3·0	14·98	12·92	2·06	2·06	2·06	14″·30
	2·5	15·75	12·20	3·55	3·58	3·59	...
	2·2	16·56	11·40	5·16	5·19	5·20	...
	2·0	17·41	10·52	6·89	6·92	6·93	...
XVII.—16th January 1885.	3·0	15·00	12·94	2·06	2·06	2·06	14″·30
	2·5	15·75	12·17	3·58	3·61	3·62	...
	2·2	16·54	11·36	5·18	5·21	5·22	...
	2·0	17·41	10·50	6·91	6·94	6·95	...
XVIII.—25th February 1886.	3·0	15·25	13·19	2·06	2·06	2·06	14″·30
	2·5	15·99	12·50	3·49	3·56	3·56	...
	2·2	16·78	11·66	5·12	5·19	5·20	...
	2·0	17·63	10·79	6·84	6·91	6·92	...
XIX.—12th May 1887.	3·0	15·04	13·01	2·03	2·03	2·03	14″·36
	2·5	15·77	12·33	3·44	3·51	3·51	...
	2·2	16·57	11·51	5·06	5·13	5·14	...
	2·0	17·43	10·67	6·76	6·83	6·84	...
	1·25	27·62	0·43	27·19	27·26	27·30	...
XX.—31st May 1888.	3·0	14·93	12·88	2·05	2·05	2·05	14″·30
	2·5	15·68	12·20	3·48	3·54	3·54	...
	2·2	16·48	11·37	5·11	5·17	5·18	...
	2·0	17·31	10·50	6·81	6·87	6·88	..
	1·25	27·54	0·27	27·27	27·33	27·36	...
XXI.—4th June 1888.	3·0	15·06	13·03	2·03	2·03	2·03	14″·30
	2·5	15·79	12·35	3·44	3·50	3·50	...
	2·2	16·60	11·51	5·09	5·15	5·15	...
	2·0	17·44	10·66	6·78	6·84	6·85	...
	1·25	27·72	0·42	27·30	27·36	27·39	..
XXII.—7th May 1888.	3·0	15·07	13·03	2·04	2·04	2·04	14″·31
	2·5	15·80	12·35	3·45	3·52	3·53	...
	2·2	16·60	11·53	5·07	5·14	5·15	..
	2·0	17·44	10·69	6·75	6·82	6·83	...
	1·25	27·63	0·46	27·17	27·24	27·29	...

TABLE 19.—*Experimental deflections of the Horizontal Force Magnetograph by the deflector Magnet E 1.*

OBSERVATIONS.

[Corresponding to Table 29 of Appendix I, 1879—82.]

Number and date of Experiment.	Local Time by Magnetograph Clock.*	Horizontal Force Magnetograph. — Scale-reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
XIII.—12th July 1882.	d. h. m.					P. and V. D.
	12 19 42	32·82	90·6	Away.	...	
	„ „ 58	38·31	...	3·0 S.	N.	
	„ 20 12	27·42	...	3·0 S.	S.	
	„ „ 23	32·81	...	Away.	...	
	„ „ 34	27·42	...	3·0 N.	S.	
	„ „ 44	38·27	...	3·0 N.	N.	
	„ „ 55	32·83	90·6	Away.	...	
	„ 21 3	42·26	...	2·5 N.	N.	
	„ „ 12	23·55	...	2·5 N.	S.	
	„ „ 20	32·81	...	Away.	...	
	„ „ 28	23·45	...	2·5 S.	S.	
	„ „ 37	42·28	...	2·5 S.	N.	
	„ „ 47	32·74	90·8	Away.	...	
	„ „ 53	46·67	...	2·2 S.	N.	
	„ 22 6	19·10	...	2·2 S.	S.	
	„ „ 14	32·74	...	Away.	...	
	„ „ 26	19·13	...	2·2 N.	S.	
	„ „ 34	46·45	...	2·2 N.	N.	
	„ „ 45	32·67	91·0	Away.	...	
	„ „ 50	Scale out of field		2·0 N.	N.	
	„ 23 2	14·65	...	2·0 N.	S.	
	„ „ 12	32·61	...	Away.	...	
	„ „ 22	14·33	...	2·0 S.	S.	
	„ „ 27	Scale out of field		2·0 S.	N.	
	„ „ 34	32·43	91·1	Away.	...	
XIV.—13th August 1883.	13 19 17	27·01	90·1	Away.	...	P. and V. G. G.
	„ „ 28	32·33	...	3·0 S.	N.	
	„ „ 41	21·61	...	3·0 S.	S.	
	„ „ 55	26·83	...	Away.	...	
	„ 20 5	21·59	...	3·0 N.	S.	
	„ „ 15	32·22	...	3·0 N.	N.	
	„ „ 25	26·82	90·3	Away.	...	
	„ „ 36	36·01	...	2·5 N.	N.	
	„ „ 48	17·77	...	2·5 N.	S.	
	„ „ 58	26·86	...	Away.	...	
	„ 21 10	17·61	...	2·5 S.	S.	
	„ „ 20	36·11	...	2·5 S.	N.	
	„ „ 30	26·81	90·3	Away.	...	
	„ „ 40	13·38	...	2·2 S.	S.	
	„ „ 56	40·35	...	2·2 S.	N.	
	„ 22 6	26·71	...	Away.	...	
	„ „ 15	13·30	...	2·2 N.	S.	
	„ „ 26	40·13	...	2·2 N.	N.	
	„ „ 36	26·73	90·9	Away.	...	
	„ „ 48	44·78	...	2·0 N.	N.	
	„ 23 0	9·16	...	2·0 N.	S.	
	„ „ 9	26·89	...	Away.	...	
	„ „ 18	8·90	...	2·0 S.	S.	
	„ „ 29	44·82	...	2·0 S.	N.	
	„ „ 40	26·65	91·0	Away.	...	
XV.—22nd September 1884.	22 19 34	21·53	88·9	Away.	...	P. and D.
	„ „ 46	26·91	...	3·0 S.	N.	
	„ „ 56	16·22	...	3·0 S.	S.	
	„ 20 9	21·50	...	Away.	...	
	„ „ 28	16·21	...	3·0 N.	S.	
XV.—22nd September 1884—*continued.*	22 20 38	26·77	...	3·0 N.	N.	P. and D.
	„ „ 48	21·45	89·0	Away.	...	
	„ „ 58	30·61	...	2·5 N.	N.	
	„ 21 6	12·38	...	2·5 N.	S.	
	„ „ 18	21·41	...	Away.	...	
	„ „ 28	12·29	...	2·5 S.	S.	
	„ „ 38	30·69	...	2·5 S.	N.	
	„ „ 48	21·41	89·2	Away.	...	
	„ „ 58	34·99	...	2·2 S.	N.	
	„ 22 10	8·04	...	2·2 S.	S.	
	„ „ 19	21·44	...	Away.	...	
	„ „ 33	8·21	...	2·2 N.	S.	
	„ „ 44	34·89	...	2·2 N.	N.	
	„ „ 52	21·49	89·4	Away.	...	
	„ 23 1	39·29	...	2·0 N.	N.	
	„ „ 18	3·76	...	2·0 N.	S.	
	„ „ 30	21·50	...	Away.	...	
	„ „ 38	3·71	...	2·0 S.	S.	
	„ „ 48	39·61	...	2·0 S.	N.	
	23 0 0	21·54	89·5	Away.	...	
XVIa.—22nd–23rd December 1884.	22 19 28	20·99	86·8	Away.	...	P. and G. S. J.
	„ „ 51	26·36	...	3·0 S.	N.	
	„ 20 4	15·72	...	3·0 S.	S.	
	„ „ 17	21·00	...	Away.	...	
	„ „ 28	15·71	...	3·0 N.	S.	
	„ „ 36	26·28	...	3·0 N.	N.	
	„ „ 46	20·97	86·8	Away.	...	
	„ „ 56	30·12	...	2·5 N.	N.	
	„ 21 6	11·92	...	2·5 N.	S.	
	„ „ 16	20·94	...	Away.	...	
	„ „ 28	11·81	...	2·5 S.	S.	
	„ „ 38	30·24	...	2·5 S.	N.	
	„ „ 47	21·00	86·9	Away.	...	
	„ „ 57	34·56	...	2·2 S.	N.	
	„ 22 7	7·63	...	2·2 S.	S.	
	„ „ 18	21·05	...	Away.	...	
	„ „ 32	7·90	...	2·2 N.	S.	
	„ „ 44	34·55	...	2·2 N.	N.	
	„ „ 56	21·59	87·1	Away.	...	
	„ 23 9	39·20	...	2·0 N.	N.	
	„ „ 22	3·50	...	2·0 N.	S.	
	„ „ 32	21·29	...	Away.	...	
	„ „ 42	3·25	...	2·0 S.	S	
	„ „ 51	38·89	...	2·0 S.	N.	
	23 0 2	20·76	87·1	Away.	...	
XVIb.—31st December 1881.	31 20 19	37·89	87·8	Away.	...	P. and V. G. G.
	„ „ 29	47·69	...	2·5 S.	N.	
	„ „ 38	28·36	...	2·5 S.	S.	
	„ „ 48	37·89	...	Away.	...	
	„ „ 58	28·30	...	2·5 N.	S.	
	„ 21 8	47·47	...	2·5 N.	N.	
	„ „ 19	37·80	87·9	Away.	...	

* Reckoned from midnight.

TABLE 19—*continued.*

Number and date of Experiment.	Local Time by Magneto-graph Clock.	Horizontal Force Magneto-graph. — Scale-reading.	Thermo-meter.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
	d. h. m.					
XVI.—4th January 1885.	4 18 19	29·92	86·9	Away.	...	P. and G. S. J.
	„ „ 32	45·06	...	2·0 S.	N.	
	„ „ 40	15·22	...	2·0 S.	S.	
	„ „ 50	29·92	...	Away.	...	
	„ „ 58	15·21	...	2·0 N.	S.	
	„ 19 6	44·75	...	2·0 N.	N.	
	„ „ 19	29·80	87·0	Away.	...	
XVII.—15th January 1885.	15 19 42	35·70	86·4	Away.	...	P. and D.
	„ „ 51	40·20	...	3·0 S.	N.	
	„ 20 2	31·18	...	3·0 S.	S.	
	„ „ 19	35·59	...	Away.	...	
	„ „ 29	31·16	...	3·0 N.	S.	
	„ „ 38	40·07	...	3·0 N.	N.	
	„ „ 46	35·59	86·7	Away.	...	
	„ „ 55	43·29	...	2·5 N.	N.	
	„ 21 8	27·83	...	2·5 N.	S.	
	„ „ 19	35·47	...	Away.	...	
	„ „ 28	27·79	...	2·5 S.	S.	
	„ „ 36	43·29	...	2·5 S.	N.	
	„ „ 45	35·42	87·0	Away.	...	
	„ „ 56	46·92	...	2·2 S.	N.	P. and G. S. J.
	„ 22 9	24·27	...	2·2 S.	S.	
	„ „ 18	35·47	...	Away.	...	
	„ „ 30	24·38	...	2·2 N.	S.	
	„ „ 38	46·89	...	2·2 N.	N.	
	„ „ 47	35·58	87·2	Away.	...	P. and D.
	„ „ 56	Scale out	of field.	2·0 N.	N.	
	„ 23 8	20·66	...	2·0 N.	S.	
	„ „ 18	35·58	...	Away.	...	
	„ „ 26	20·71	...	2·0 S.	S.	
	„ „ 35	Scale out	of field.	2·0 S.	N.	
	„ „ 44	35·60	87·3	Away.	...	
XVIII.—24th—25th February 1886.	24 20 38	31·99	88·0	Away.	...	V. N. and P.
	„ „ 49	36 42	...	3·0 S.	N.	
	„ „ 59	27·41	...	3·0 S.	S.	
	„ 21 6	31·66	...	Away.	...	
	„ „ 22	27·35	...	3·0 N.	S.	
	„ „ 31	36·11	...	3·0 N.	N.	
	„ „ 39	31·58	88·4	Away.	...	
	„ „ 47	39·15	...	2·5 N.	N.	
	„ „ 54	24.02	...	2·5 N.	S.	
	„ 22 4	31·47	...	Away.	...	
	„ „ 13	23·91	...	2·5 S.	S.	
	„ „ 19	39·38	...	2·5 S.	N.	
	„ „ 33	31·47	88·7	Away.	...	
	„ „ 46	42·80	...	2·2 S.	N.	
	„ „ 58	20·42	...	2·2 S.	S.	
	„ 23 6	31·55	...	Away.	...	
	„ „ 13	20·60	...	2·2 N.	S.	
	„ „ 22	42·87	...	2·2 N.	N.	
	„ „ 30	31·65	88·8	Away.	...	
	„ „ 37	46·58	...	2·0 N.	N.	
	„ „ 46	16·97	...	2·0 N.	S.	
	„ „ 55	31·48	...	Away.	...	
	25 9 4	16·71	...	2·0 S.	S.	
	„ „ 11	46·42	...	2·0 S.	N.	
	„ „ 19	31·41	88·9	Away.	...	

Number and date of Experiment.	Local Time by Magneto-graph Clock.	Horizontal Force Magneto-graph. — Scale-reading.	Thermo-meter.	Magnet E1. Distance in feet.	Magnet E1. North end.	Observer.
	d. h. m.					
XIX.—11th May 1887.	11 19 21	27·20	92·5	Away.	...	V. N. and P.
	„ „ 30	31·61	...	3·0 S.	N.	
	„ „ 39	22·80	...	3·0 S.	S.	
	„ „ 46	27·02	...	Away.	...	
	„ „ 58	22·64	...	3·0 N.	S.	
	„ 20 8	31·39	...	3·0 N.	N.	
	„ „ 19	27·19	92·6	Away.	...	
	„ „ 28	34·72	...	2·5 N.	N.	
	„ „ 38	19·69	...	2·5 N.	S.	
	„ „ 45	27·10	...	Away.	...	
	„ „ 55	19·65	...	2·5 S.	S.	
	„ 21 6	34·79	...	2·5 S.	N.	
	„ „ 19	27·30	92·8	Away.	...	
	„ „ 28	38·50	...	2·2 S.	N.	
	„ „ 38	16·38	...	2·2 S.	S.	
	„ „ 47	27·29	...	Away.	...	
	„ „ 56	16·40	...	2·2 N.	S.	
	„ 22 10	38·38	...	2·2 N.	N.	
	„ „ 19	27·39	92·8	Away.	...	
	„ „ 29	42·00	...	2·0 N.	N.	
	„ „ 41	12·90	...	2·0 N.	S.	
	„ „ 50	27·30	...	Away.	...	
	„ „ 58	12·70	...	2·0 S.	S.	
	„ 23 8	42·00	...	2·0 S.	N.	
	„ „ 19	27·20	92·9	Away.	...	
XX.—30th—31st May 1888	30 20 19	23·72	94·1	Away.	...	V. N. and V. G. C.
	„ „ 31	28·10	...	3·0 S.	N.	
	„ „ 40	19·43	...	3·0 S.	S.	
	„ „ 49	23·73	...	Away.	...	
	„ 21 0	19·45	...	3·0 N.	S.	
	„ „ 9	28·09	...	3·0 N.	N.	
	„ „ 19	23·75	94·2	Away.	...	
	„ „ 29	31·22	...	2·5 N.	N.	
	„ „ 40	16·32	...	2·5 N.	S.	
	„ „ 50	23·70	...	Away.	...	
	„ 22 0	16·27	...	2·5 S.	S.	
	„ „ 10	31·26	...	2·5 S.	N.	
	„ „ 19	23·65	94·2	Away.	...	
	„ „ 30	34·70	...	2·2 S.	N.	
	„ „ 40	12·81	...	2·2 S.	S.	
	„ „ 50	23·69	...	Away.	...	
	„ 23 0	12·89	...	2·2 N.	S.	
	„ „ 12	34·63	...	2·2 N.	N.	
	„ „ 19	23·71	94·2	Away.	...	
	„ „ 31	38·24	...	2·0 N.	N.	
	„ „ 42	9·40	...	2·0 N.	S.	
	„ „ 50	23·75	...	Away.	...	
	31 0 0	9·34	...	2·0 S.	S.	
	„ „ 10	38·49	...	2·0 S.	N.	
	„ „ 19	23·80	94·2	Away.	...	
XXI.—2nd June 1888.	2 19 19	35·45	94·1	Away.	...	V. N. and V. G. C.
	„ „ 31	39·90	...	3·0 S.	N.	
	„ „ 41	31·11	...	3·0 S.	S.	
	„ „ 50	35·49	...	Away.	...	
	„ 20 0	31·14	...	3·0 N.	S.	
	„ „ 10	39·89	...	3·0 N.	N.	
	„ „ 19	35·48	94·4	Away.	...	
	„ „ 32	43·08	...	2·5 N.	N.	
	„ „ 42	27·99	...	2·5 N.	S.	
	„ „ 50	35·45	...	Away.	...	
	„ 21 0	27·94	...	2·5 S.	S.	

TABLE 19—*continued.*

Number and date of Experiment.	Local Time by Magnetograph Clock.	Horizontal Force Magnetograph. Scale-reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
XXI.—2nd June 1888—*contd.*	d. h. m.					
	2 21 10	43·11	...	2·5 S.	N.	V. N. and V. G. G.
	,, ,, 19	35·51	94·8	Away.	...	
	,, ,, 31	46·67	...	2·2 S.	N.	
	,, ,, 40	24·48	...	2·2 S.	S.	
	,, ,, 50	35·45	...	Away.	...	
	,, 22 0	24·52	...	2·2 N.	S.	
	,, ,, 10	46·57	...	2·2 N.	N.	
	,, ,, 19	35·46	94·9	Away.	...	
	,, ,, 34	50·22*	...	2·0 N.	N.	
	,, ,, 44	21·01	...	2·0 N.	S.	
	,, ,, 51	35·50	...	Away.	...	
	,, 23 0	20·91	...	2·0 S.	S.	
	,, ,, 11	50·40*	...	2·0 S.	N.	
	,, ,, 19	35·57	95·0	Away.	...	
XXII.—6th May 1889.	6 19 22	32·91	92·7	Away.	...	V. N. and V. G. G.
	,, ,, 34	37·30	...	3·0 S.	N.	
	,, ,, 42	28·57	...	3·0 S.	S.	
	,, ,, 51	32·93	...	Away.	...	
	,, 20 1	28·60	...	3·0 N.	S.	

Number and date of Experiment.	Local Time by Magnetograph Clock.	Horizontal Force Magnetograph. Scale-reading.	Thermometer.	Magnet E 1. Distance in feet.	Magnet E 1. North end.	Observer.
XXII.—6th May 1889—*continued.*	d. h. m.					
	6 20 9	37·30	...	3·0 N.	N.	V. N. and V. G. G.
	,, ,, 19	32·91	92·9	Away.	...	
	,, ,, 29	40·43	...	2·5 N.	N.	
	,, ,, 39	25·49	...	2·5 N.	S.	
	,, ,, 49	32·90	...	Away.	...	
	,, ,, 59	25·44	...	2·5 S.	S.	
	,, 21 9	40·49	...	2·5 S.	N.	
	,, ,, 19	32·87	93·0	Away.	...	
	,, ,, 29	44·00	...	2·2 S.	N.	
	,, ,, 39	21·93	...	2·2 S.	S.	
	,, ,, 52	32·86	...	Away.	...	
	,, 22 2	22·01	...	2·2 N.	S.	
	,, ,, 12	43·87	...	2·2 N.	N.	
	,, ,, 19	32·86	93·1	Away.	...	
	,, ,, 32	47·47	...	2·0 N.	N.	
	,, ,, 43	18·47	...	2·0 N.	S.	
	,, ,, 50	32·88	...	Away.	...	
	,, ,, 59	18·40	...	2·0 S.	S.	
	,, 23 9	47·67	...	2·0 S.	N.	
	,, ,, 19	32·87	93·2	Away.	...	

* The scale extending only to the division 50, these numbers were obtained by estimation of the excess above 50 on a loose paper extension of the scale.

TABLE 20.—*Experimental deflections of the Horizontal Force Magnetograph by the deflector Magnet E 1.*

CALCULATION, FROM THE DATA IN TABLE 19, OF THE DOUBLE DEFLECTIONS.

[Corresponding to Table 29*a* of Appendix I, 1879—82.]

Number and date of Experiment.	Distance.	Means. Higher readings.	Means. Lower readings	Difference or double deflection.	Value of one division of scale.
XIII. 12th July 1882.	3·0	38·29	27·42	10·87	8′·29
	2·5	42 27.	23·50	18·77	...
	2·2	46·56	19·12	27·44	...
XIV. 13th August 1883.	3·0	32·27	21·60	10·67	8′·29
	2·5	36·06	17·69	18·37	...
	2·2	40·24	13·34	26·90	...
	2·0	44·80	9·03	35·77	..
XV. 22nd September 1884.	3·0	26·84	16·21	10·63	8′·29
	2·5	30 65	12·33	18·32	...
	2·2	34·94	8·12	26·82	...
	2·0	39·45	3·73	35·72	...
XVI *a*. 22nd December 1884.	3·0	26·32	15·72	10·60	8′·29
	2·5	30·18	11·87	18·31	...
	2·2	34·55	7·77	26·78	...
	2·0	39·04	3·37	35·67	...
XVI *b*. 31st December 1884.	2·5	47·58	28·33	19·25	8′·29
XVI *c*. 4th January 1885.	2·0	44·90	15·22	29·68	8′·29

Number and date of Experiment.	Distance.	Means. Higher readings.	Means. Lower readings.	Difference or double deflection.	Value of one division of scale.
XVII. 15th January 1885.	3·0	40·13	31·17	8·96	8′·29
	2·5	43·29	27·81	15·48	...
	2·2	46·90	24·33	22·57	...
	2·0	50·65	20·68	29·97	...
XVIII. 24th February 1886.	3·0	36·26	27·38	8·88	8′·29
	2·5	39·26	23·96	15·30	...
	2·2	42·83	20·51	22·32	...
	2·0	46·50	16·84	29·66	...
XIX. 11th May 1887.	3·0	31·50	22·72	8·78	8′·29
	2·5	34·75	19·67	15·08	...
	2·2	38·44	16·39	22·05	...
	2·0	42·00	12·80	29·20	...
XX. 30th May 1888.	3·0	28·09	19·44	8·65	8′·29
	2·5	31·24	16·29	14·95	...
	2·2	34·66	12·85	21·81	...
	2·0	38·36	9·37	28·99	...
XXI. 2nd June 1888.	3·0	39·89	31·12	8·77	8′·29
	2·5	43·09	27·96	15·13	...
	2·2	46·62	24·50	22·12	...
	2·0	50·31	20·96	29·35	...
XXII. 6th May 1889.	3·0	37·30	28·58	8·72	8′·29
	2·5	40·46	25·46	15·00	...
	2·2	43·93	21·97	21·96	...
	2·0	47·57	18·43	29·14	...

41. Appendix I, 1879—82, paragraph 90.

TABLE 21.—*Showing values of the ratio* $\frac{d'}{d}$, *where d' is the double deflection of the Magnet N 3 in the Electrometer Tower and d is the deflection of the horizontal force magnetograph—both by the deflector Magnet E 1.*

[Corresponding to Table 30 of Appendix I, 1879—82.]

Line.	Experiment and date.	r (IN FEET).				
		1·5	2·0	2·2	2·5	3·0
1	XII. 6—8 June 1882	·79678	·79795	...	·80624	·79924
2	XIII. 12—13 July 1882...	...	...	·19242	·19393	·19227
3	XIV. 13—14 August 1883	...	·19402	·19331	·19543	·19588
4	XV. 22—23 September 1884	...	·19345	·19277	·19432	·19379
5	XVI. 22—23 December 1884	...	·19428	·19417	·19607	·19434
6	Means (XIII. to XVI.)	...	...	·19317	·19494	·19407
7	XVII. 15—16 January 1885	...	·23190	·23128	·23385	·22991
8	XVIII. 24—25 February 1886	...	·23331	·23297	·23268	·23198
9	Means. (XVII. and XVIII.)	...	·23260	·23212	·23326	·23094

42. Appendix I, 1879—82, paragraph 91. As in the paragraph referred to, the mean numbers in the 6th and 9th lines of Table 21 were used for the calculation of the constant p in the expression $D=\frac{d'}{d}\left(1-\frac{p}{r^2}\right)$, and with the respective results $p=-\cdot05405$ and $p=+\cdot03768$ but as the mean numbers are in neither case progressively increasing or progressively decreasing, and as the values of p yielded are of opposite sign, we conclude that error of observation plays a greater part in giving an apparent value to p than systematic variation of the mean ratios, and these being moreover, in each case, in fair accord with each other, we decide to adopt the value $p=0$. This is equivalent, it will be observed, to assuming that the magnetism of the two magnets—N 3 and that of the horizontal force magnetograph—is similarly distributed in them.

43. Appendix I, 1879—82, paragraph 92. We shall now assume that the theoretical ratios are the same for all distances, and the probable error of deflections, both of the declination magnet and of the horizontal force magnet, being the same for all deflections, whether great or small, we shall add the numerators and denominators of the ratios for the several distances together, and take the ratio $(\frac{\Sigma d'}{\Sigma d})$ of the sums as the theoretical ratio for a particular set of experiments. It is obvious that there will be some compensation of errors in adding the deflections together, and also that the remaining probable errors of the sums will have less relative effect (that is, effect on the ratio) than the probable errors for the single distances have upon their respective ratios. But if $\Sigma d'$ be first multiplied by a', the value, corrected for torsion of the suspension thread, of a division of the scale in which the auxiliary deflections (d') are observed, and Σd by a, the division will then give the change of force, in terms of the horizontal force as unit, *per* unit arc of change of position of the horizontal force magnet; in other words, it will give $\frac{1}{dv}\frac{dX}{X}$. It is in this manner that the scale-coefficients shown in column 17 of Table 22 have been obtained from the data that appear alongside of them.

TABLE 22.

[Corresponding to Table 32 of Appendix I, 1879—82.]

Experiment and date.	Double Deflections.																
	Of Magnet.	At Distance (r).				$\Sigma d'$	a'		$a'\ \Sigma d'$	Of Horizontal Force Magnetograph (d).				Σd	$a\ \Sigma d$	$\frac{a'\Sigma d'}{a\ \Sigma d} = \frac{I}{dv}\frac{dX}{X}$	Corresponding scale-reading.
		2·0	2·2	2·5	3·0		Minutes.	Arc. / Radius.		At distance (r).					$a = ·00241$		
										2·0	2·2	2·5	3·0				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
XIII. 12th—13th July 1882 ...	N 3	...	5·28	3·64	2·09	11·01	14′·30	·004160	·04580	...	27·44	18·77	10·87	57·08	·13756	·33295	32·78
XIV. 13th—14th August 1883 ...	N 3	6·98	5·22	3·60	2·10	17·90	14′·30	·004160	·07446	35·77	26·90	18·37	10·67	91·71	·22102	·33689	26·81
XV. 22nd—23rd September 1884 .	N 3	6·91	5·17	3·56	2·06	17·70	14′·34	·004171	·07383	35·72	26·82	18·32	10·63	91·49	·22049	·33485	21·48
XVI. 22nd—23rd December 1884 .	N 3	6·93	5·20	3·59	2·06	17·78	14′·30	·004160	·07396	35·67	26·78	18·31	10·60	91·36	·22018	·33591	21·07
XVI *a*. 3rst December 1884 ...	N 3	...	...	3·60	...	3·60	14′·30	·004160	·01498	...	...	19·25	...	19·25	·04639	·32291	37 86
XVI *b*. 4th January 1885	N 3	6·94	...	...	...	6·94	14′·30	·004160	·02887	29·68	...	...	...	29·68	·07153	·40361	29·88
XVII 15th—16th January 1885 ...	N 3	6·95	5·22	3·62	2·06	17·85	14′·30	·004160	·07426	29·97	22·57	15·48	8·96	76·98	·18552	·40028	35·56
XVIII. 24th—25th February 1886 ...	N 3	6·92	5·20	3·56	2·06	17·74	14′·30	·004160	·07380	29·66	22·32	15·30	8·88	76·16	·18355	·40207	31·58

* The strong horizontal lines in column 17 separate determinations belonging to one undisturbed adjustment of the instrument from those belonging to other undisturbed adjustments.

44. After discovering that values of the ratios $\frac{d'}{d}$ for distances between 2·0 and 3·0 feet were differently affected by the constant p to a less extent than by errors of observation, and could not therefore lead to an accurate evaluation of p, it was resolved to observe one large deflection of magnet N 3 by magnet E 1, as part of each large set of deflection experiments, and to combine that one with all the others, in the manner described in paragraph 10 for the determination of the p applicable in this case: the distance chosen for the one large deflection was 1·25 feet. It will readily be seen that equation (13) is applicable to this case, where the deflector magnet is end-on to the suspended magnet, as well as to the case in which it is side-on. Applying it to the four sets of deflections made on this plan, since the 11th May 1887, with the data shown in Table 23, we obtain the values of p entered in column 12 of the same table.

TABLE 23.—*Deflections of Magnet N 3 by Magnet E 1, end-on: data for calculation of p and results for each experiment.*

Experiment and date.	Double Deflection in Scale Divisions. d'	d				Σd	$\frac{1}{r_1^3}$	$\frac{1}{r_1^5}$	$\Sigma\frac{1}{r^3}$	$\Sigma\frac{1}{r^5}$	Deduced value of p
		Distance in feet.									
	1·25	2·0	2·2	2·5	3·0						
1	2	3	4	5	6	7	8	9	10	11	12
XIX. 12th May 1887 ...	27·26	6·83	5·13	3·51	2·03	17·50	·51200	·32768	·31995	·06501	−·06611
XX. 31st May 1888 ...	27·33	6·87	5·17	3·54	2·05	17·63	·51200	·32768	·31995	·06501	−·07056
XXI. 4th June 1888 ...	27·36	6·84	5·15	3·50	2·03	17·52	·51200	·32768	·31995	·06501	−·05451
XXII. 7th May 1889 ...	27·24	6·82	5·14	3·52	2·04	17·52	·51200	·32768	·31995	·06501	−·06417
										Mean (and adopted) value of p	−·06234

45. To render the investigations of paragraphs 8 and 9 applicable to this case generally, we must regard Y as the disturbing force produced by the presence of the deflector magnet E 1 end-on to the magnet N 3 or to the magnet of the horizontal force magnetograph, as the case may be. The second of the fundamental formulæ will then become

$$\frac{Y}{Z} = \frac{M}{r^3}\left(1 + \frac{p}{r^2}\right) \qquad (2a)$$

and thence,

$$\frac{Y}{Z} = JX \sin u \frac{1}{r^3}\left(1 + \frac{p}{r^2}\right), \text{ and} \qquad (8a)$$

$$J = \frac{a'\left(1+\frac{JI}{F}\right)}{4 \sin u} \cdot \frac{\Sigma d}{\Sigma\left\{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)\right\}} \qquad (10a)$$

And now, embodying all the deflections of a particular experiment, we have

$$\frac{1}{dv}\frac{dX}{X} = \frac{\Sigma\Delta X}{X\Sigma dv} = \frac{\Sigma Y}{Xa\,\Sigma\frac{d}{2}} = \frac{2JX \sin u\, \Sigma\left\{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)\right\}}{Xa\,\Sigma\frac{d}{2}} = \frac{4J \sin u\, \Sigma\left\{\frac{1}{r^3}\left(1 + \frac{p}{r^2}\right)\right\}}{a\,\Sigma d} \qquad (19)$$

46. In the following table are shown for each experiment the data for and the results of the calculation by equation (10*a*) of J.

TABLE 24.—*Deflections of Magnet N3 by Magnet E1: data for calculation of J and results for each of the experiments XIX to XXII of Table 18.*

Experiment and date.	a'	$1+\frac{H}{F}$	u	Σd	$\Sigma\left\{\frac{1}{r^3}\left(1+\frac{p}{r^2}\right)\right\}$	J
1	2	3	4	5	6	7
XIX. 12th May 1887 ...	·00418	1·00130	6° 40′ 45″	17·50	·31589	·49826
XX. 31st May 1888 ...	·00416	1·00101	6° 38′ 27″	17·63	·31589	·50240
XXI. 4th June 1888 ...	·00416	1·00095	6° 38′ 27″	17·52	·31589	·49923
XXII. 7th May 1889 ...	·00416	1·00167	6° 37′ 32′	17·52	·31589	·50073
					Mean (and adopted) value of J=·50015	

None of the values of J given separately by the four experiments differ so much from the mean of the four as $\frac{1}{200}$th of the whole, and the mean may therefore be adopted generally.

47. In Table 25 are shown the data for and the results of the calculations by equation (19) of $\frac{1}{dv}\frac{dX}{X}$ for each of the experiments XIX to XXII of Table 20.

TABLE 25.—*Calculation of* $\frac{1}{dv}\frac{dX}{X}$.

Experiment and date.	Adopted value of J=0·50015 and of a=0·00241.				
	sin u.	$\Sigma\left\{\frac{1}{r^3}\left(1+\frac{p}{r^2}\right)\right\}$	Σd	$\frac{1}{dv}\frac{dX}{X}$	Corresponding scale-reading.
XIX. 11th—12th May 1887 ...	·11631	·31589	75·11	·40607	27·22
XX. 30th—31st May 1888 ...	·11565	·31589	74·40	·40761	23·72
XXI. 2nd—4th June 1888 ...	·11565	·31589	75·37	·40236	35·48
XXII. 6th—7th May 1889 ...	·11538	·31589	74·82	·40438	32·89

48. Appendix I, 1879—82, paragraphs 93 to 99. The scale-reading determined experimentally as that which placed the magnetic axis of the horizontal force magnet at right angles to the magnetic meridian on the 5th March 1872 was 25·56 (see Appendix I, 1879—82, paragraph 98); but on the 26th March 1872 (see Appendix I, 1879—82, paragraph 98) the mirror was accidentally moved on its axis so as to increase the scale-reading by 1·19 divisions; and on the 1st January 1883 the renewal of the object glass of the reading telescope introduced a permanent decrease of 0·48 in the scale-readings: consequently the position of the magnet which had for its scale-reading 25·56 on the 5th March 1872 would have 25·56 + 1·19 = 26·75 for its scale-reading after the 26th March 1872, and 26·75 − 0·48 = 26·27 after the 1st January 1883.

49. On the 3rd January 1885 the mirror of the magnet was intentionally turned on its axis, thus again altering the relation between the scale-reading and the position of the magnet by a constant quantity. The new reading corresponding to the *true* direction N. 89° 4′ W. of the axis of figure of the magnet was found by pushing the magnet a little aside with a straight-edged bar of wood, so as to prevent it from oscillating, and making its edge take up a direction nearly parallel to the line of collimation of the reading telescope, and by then reading the scale which was at 23·40. The line of collimation of the telescope, which has the direction N. 88° 38′ W. (see above—paragraph 3), is parallel to the horizontal line drawn from the division 25·00 of the scale to a point above the centre of the magnet carrier, but the exact direction of the magnet was from the scale-division 23·1 to

the same point, and was therefore N.{88° 38′ + 2 (25·0—23·1) 8′·29}W. = N. 89° 10′ W.: hence the scale-reading corresponding to the true direction N. 89° 4′ W. is $23{\cdot}40 + \frac{6}{8{\cdot}29} = 24{\cdot}12$. On the 6th March 1872 this scale-reading was, however, 21·55 (see Appendix I, 1879—82, paragraph 99) and relatively to that time the scale-reading for any given direction of the magnet has increased by (24·12—21·55)=2·57; and hence, the mean absolute declination from 1882 to 1888 being, for this purpose, practically the same as in March 1872,* the scale-reading which implies that the axis of the magnet is at right angles to the magnetic meridian, and which on the 5th March 1872 was 25·56, will now be 28·13.

50. We thus have for the scale-reading that placed the magnetic axis of the magnet at right angles to the magnetic meridian —25·56 from 5th to 26th March 1872; 26·75 from 26th March 1872 to 1st January 1883; 26·27 from 1st January 1883 to 3rd January 1885; and 28·13 from 3rd January 1885 to 30th April 1889 and onward: but the values of S the corresponding readings adopted in the calculation of the scale-coefficients, for which purpose very exact values are not required, have been 25·56 from March 1872 up to the end of 1884 and 29·31 from January 1885 to April 1889 and onward.

51. Although no assumption is made to this effect in the procedure of paragraph 49, it may be here stated that the sides of the magnet are straight and parallel to each other, and are parallel also to the magnetic axis of the magnet: on the 3rd January 1885 the first two points were found by inspection and by measurement of the uniformity of breadth of the bar to be as stated, and the last was tested by suspending the magnet in a unifilar magnetometer with its side pressed against the flat side of a brass carrier, first with one of its flat surfaces upward and then with the other, and reading the scale in the two cases: the equivalent angle to half the difference of two scale-readings was in one set of trials *zero*, and in a second set less than half a minute.

52. The adoption of 25·56 as the value of S on the 5th March 1872 and of 21·55 as corresponding to the *true* direction of the axis of the magnet N. 89°4′ W. the day after implies, it should be pointed out, the adoption of a value, for that time and the place of the instrument, of the absolute declination: for the latter number gives for the *true* direction N. 90° W. the scale-reading $21{\cdot}55 - \frac{56}{8{\cdot}29} = 14{\cdot}79$; and the excess of 25·56 over this, converted into arc, or (25·56—14·79) × 8′·29=1° 29′ E., is the declination in question: this, it should be observed, is 36′ greater than the absolute declination of that time (0°53′E.) observed in the Electrometer Tower.

53. Appendix I, 1879—82, paragraph 100. The importance of having the magnet nearly at right angles to the magnetic meridian lies not in its effect on the scale-coefficient, as will be seen later, but in the introduction otherwise of the variations of declination, in small proportion, into the record of variations of horizontal force. The amount of adulteration of this kind is expressed by the last term of equation (3), paragraph 87 of Appendix I, 1879—82, and depends on the value of cot $(A-v)$, or as $(A-v)$ is nearly 90°, (say) on the arc $\{90° - (A-v)\}$: the maximum and minimum scale-readings observed during each of the periods 14th July 1882 to 30th December 1884 and 6th January 1885 to 9th May 1889 were 35·19 and 16·17 and 37·20 and 21·88 respectively, giving maximum departures from the scale-readings 26·75 or 26·27 in the first case, and 28·13 in the second, or values of $\{90° - (A-v)\}$, of 1° 28′ and 1° 15′, or in arc of ·026 and ·022: that is to say about $\frac{3}{8}$th and $\frac{1}{15}$th are the proportions in which, in the extreme cases, the diurnal variation of declination—the average range of which is ·0031 unit of force—is mixed up with the record of the diurnal variations of horizontal force. When instead of hourly scale-readings monthly means only are considered, as would better correspond with the use that is made of the records, the departures are reduced to about two-thirds of these. It was to reduce the adulteration of the record caused by these departures that both the magnet mirror and the zero mirror were turned on their axes on the 3rd January 1885, in accordance with the purpose stated in Appendix I, 1879—82, paragraph 102.

Appendix I, 1879—82, paragraph 101 (see above—foot-note to paragraph 49).

Appendix I, 1879—82, paragraphs 102 and 103 (see above—last paragraph).

54. Appendix I, 1879—82, paragraph 104. Continuing the paragraph here referred to, the changes of adjustment of the horizontal force magnetograph that have been made are the following—

(7) On the 1st January 1883 the old lens of the reading telescope, which had become fogged and gave a somewhat weak image of the scale, was substituted

* The mean absolute declination of March 1872 was 0° 52′ 52″ E., and that of the seven years 1882 to 1888 was 0° 54′ 32″ E.

by a new one. The effect of the change was to reduce the scale-readings by 0·48.

(8) On 31st December 1884 and 1st January 1885 the torsion circle reading was increased from 356° 10′ to 3° 48′: in moving the verniers which were stiffly adhering to the circle it was suspected that the circle also moved in its bed against the pressure of the three binding screws, and to correct this a reverse movement was given to the circle. The distance apart of the wires at top was also altered.

A new thermometer with white porcelain scale was substituted for the old one with ivory scale.

On the 3rd January 1885 the magnet mirror and the zero mirror were both turned on their axes.

On the 5th January 1885 the wires were brought closer together at top.

(9) On the 1st June 1888 the wires were brought closer together at top.

55. Appendix I, 1879—82, paragraph 105. Now separating the determinations of $\frac{1}{dv}\frac{dX}{x}$ of Tables 22 and 25 that belong to each of the several undisturbed adjustments of the instrument, we obtain groups as follows, *viz.*, experiments XIII to XVI; XVII and XVIII; and XIX to XXII. The determination XVI*a* is applicable to the 31st December 1884 only, and XVI*b* is merely confirmatory of the applicability of the following determination—the mean of XVII and XVIII—backward to the 4th January 1885, and—having regard to the change of the magnet mirror and zero mirror—further backward to the 1st January 1885. Taking then for each experiment of a particular group, for S the value 25·56 from July 1882 to December 1884 and 29·31 from January 1885 to May 1889, and considering appropriate pairs of values of s and $\frac{1}{dv}\frac{dX}{X}$, in connection with the equation

$$\frac{1}{dv}\frac{dX}{X}=\frac{1}{dv}\frac{dX_o}{X_o}-a\cot^2 v_o(s-S) \qquad (20)$$

(see Appendix I, 1879—82, paragraph 88) we have determined a mean value for that group of cot v_o, by the method of successive approximation described in Appendix I, 1879—82, paragraph 105. The results are shown in Table 26.

TABLE 26.

Experiment and date.	$\frac{1}{dv}\frac{dX}{X}$ (observed).	s	$s-S$	Third values of $\frac{1}{dv}\frac{dX}{X}$	Calculated final value of $\frac{1}{dv}\frac{dX_o}{X_o}$ or cot v_o.	$\frac{a}{dv}\frac{dX_o}{X_o}$ $a=$ ·00241.	$a^2\cot^2 v_o$.	Period to which applicable.
1	2	3	4	5	6	7	8	9
XIII. 12th—13th July 1882 ...	·33295	32·78	+7·22	·33490				
XIV. 13th—14th August 1883 ..	·33689	26·81	+1·25	·33723	·33514	·00080769	·000000065236	From July 1, 1882, to December 30, 1884.
XV. 22nd—23rd September 1884 .	·33485	21·48	—4·08	·33375				
XVI. 22nd—23rd December 1884 .	·33591	21·07	—4·49	·33470				
XVI*a*. 31st December 1884	·32291	37·86	+12·30	·32606	·32606	·00078581	·000000061750	December 31, 1884.
XVI*b*. 4th January 1885	·40361	29·88	+0·57	·40383	·40383	·00097324	·000000094720	
XVII. 15th—16th January 1885 .	·40028	35·56	+6·25	·40272				
XVIII. 24th—25th February 1886 ...	·40207	31·58	+2·27	·40296	·40284	·00097085	·000000094254	January 1, 1885, to February 23, 1886.
XIX. 11th—12th May 1887 ...	·40607	27·22	—2·09	·40524				
XX. 30th—31st May 1888 ...	·40761	23·72	—5·59	·40540				
XXI. 2nd—4th June 1888	·40236	35·48	+6·17	·40480	·40531	·00097681	·000000095416	February 24, 1886, to May 6, 1889.
XXII. 6th—7th May 1889	40438	32·89	+3·58	·40580				

56. It will be noticed that, as the last term of equation (20) varies as $(s-S)$, it is unimportant whether, within moderate limits, S be chosen somewhat greater or somewhat smaller than the scale-reading which places the axis of the magnet at right angles to the magnetic meridian, seeing that a complementary change of opposite sign will be introduced thereby into the first term $\frac{1}{dv}\frac{dX_o}{X_o}$, and the two terms together will still express correctly—errors of observation apart—the individual values of $\frac{1}{dv}\frac{dX}{X}$ that compose a group. It was to this freedom of choice—within limits—of a standard value of S that we referred, in paragraph 48, when saying that very exact values of S were not required.

57. Appendix I, 1879—82, paragraph 106. The average difference, regardless of signs, between the several values of $\frac{1}{dv}\frac{dX}{X_o}$, shown in column 5, of a particular group and the

mean value of that group shown in column 6, may be taken as affording a rough estimate of the probable error of a single determination of the scale-coefficient: for experiments XIII to XVI this average is $\frac{1}{322}$th, for XVII and XVIII $\frac{1}{2357}$th, and for XIX to XXII $\frac{1}{1398}$th of the whole coefficient. Except the first, these averages are of a satisfactory order of smallness as compared with our general limit of accuracy of $\frac{1}{200}$th; and the larger order of the first is due principally to the experiment XIV: the auxiliary deflections of this experiment appear to be of the inferior order of accuracy of the older similar observations; whilst for some yet unexplained reason, and to which the observers can give no clue, the remainder of the auxiliary deflection observations of the later series are much more accordant with each other than were those of the earlier series. The means for the groups XVII and XVIII and XIX to XXII differ by $\frac{1}{164}$th of the whole coefficient, and the individual values of the first group are both less than any of the individual values of the last: there was no change of adjustment between the XVIIIth and XIXth experiments, and the change introduced into the mode of reduction, utilizing one large auxiliary deflection, involved no change in the principle of procedure that might explain even so small a discrepancy as the difference between the two mean numbers.

58. Appendix I, 1879—82, paragraph 107. Multiplying equation (20) right through by Xa, it becomes

$$Xa\,\frac{1}{dv}\,\frac{dX}{X} = Xa\,\frac{1}{dv}\,\frac{dX_o}{X_o} - Xa^2\,cot^2\,v_o\,(s-S) \qquad (21)$$

which expresses the scale-coefficient in terms of the unit of force. Referring to columns 7 and 8 of Table 26 for the coefficients $\frac{a}{dv}\frac{dX_o}{X_o}$ and $a^2\,cot^2\,v_o$, and inserting in this equation the monthly mean values of X and s we obtain monthly values of the scale-coefficient as shown in the following table.

TABLE 27.

Constants.	Month.			* X	s	$X\frac{a}{dv}\frac{dX}{X}$ (calculated) $=\frac{dX}{ds}$	$\frac{dX}{ds}$
$\frac{a}{dv}\frac{dX_o}{X_o} = \cdot 00080769$; $a^2\,cot^2\,v_o = \cdot 00000065236$.	July	1882	... ...	3·7347	33·28	·00300	·01037
	August	,,	... ...	3·7346	32·44	·00300	·01038
	September	,,	... ...	3·7346	32·55	·00300	·01038
	October	,,	... ...	3·7345	31·16	·00300	·01039
	November	,,	... ...	3·7344	30·08	·00301	·01040
	December	,,	... ...	3·7344	30·36	·00300	·01040
	January	1883	... ...	3·7328	29·97	·00300	·01039
	February	,,	... ...	3·7326	29·60	·00300	·01040
	March	,,	... ...	3·7325	29·19	·00301	·01040
	April	,,	... ...	3·7324	28·87	·00301	·01040
	May	,,	... ...	3·7322	28·36	·00301	·01041
	June	,,	... ...	3·7321	27·86	·00301	·01041
	July	,,	... ...	3·7319	27·35	·00301	·01041
	August	,,	... ...	3·7318	27·05	·00301	·01042
	September	,,	... ...	3·7316	26·17	·00301	·01042
	October	,,	... ...	3·7315	25·99	·00301	·01042
	November	,,	... ...	3·7313	25·50	·00301	·01043
	December	,,	... ...	3·7312	25·48	·00301	·01043
	January	1884	... ...	3·7391	25·51	·00302	·01045
	February	,,	... ...	3·7394	25·18	·00302	·01045
	March	,,	... ...	3·7397	24·75	·00302	·01046
	April	,,	... ...	3·7400	24·32	·00302	·01046
	May	,,	... ...	3·7403	23·96	·00302	·01047
	June	,,	... ...	3·7406	23·27	·00303	·01047
	July	,,	... ...	3·7409	22·70	·00303	·01048
	August	,,	... ...	3·7412	22·74	·00303	·01048
	September	,,	... ...	3·7415	22·28	·00303	·01048
	October	,,	... ...	3·7418	21·68	·00303	·01049
	November	,,	... ...	3·7420	21·36	·00303	·01049
	December	,,	... ...	3·7424	21·24	·00303	·01049
$\frac{a}{dv}\frac{dX_o}{X_o} = \cdot 00097085$; $a^2\,cot^2\,v_o = \cdot 00000094254$.	January	1885	... ...	3·7431	35·62	·00361	·01250
	February	,,	... ...	3·7434	35·56	·00361	·01250
	March	,,	... ...	3·7437	35·32	·00361	·01250
	April	,,	... ...	3·7441	35·02	·00361	·01251
	May	,,	... ...	3·7444	34·28	·00362	·01252
	June	,,	... ...	3·7447	34·03	·00362	·01252
	July	,,	... ...	3·7450	34·03	·00362	·01252
	August	,,	... ...	3·7453	33·48	·00362	·01253
	September	,,	... ...	3·7456	33·00	·00362	·01254
	October	,,	... ...	3·7460	32·93	·00362	·91254
	November	,,	... ...	3·7463	32·63	·00363	·01254
	December	,,	... ...	3·7466	32·57	·00363	·01255
	January	1886	... ...	3·7406	31·95	·00362	·01253
	Feb. (1st to 23rd)	1886	...	3·7406	31·74	·00362	·01254

*The monthly values of X are calculated from the annual mean values of the two preceding years of the absolute determinations, (corrected to the mean scale-readings—for 24 hours—of the large horizontal force magnetometer), on the assumption that secular change from month to month is at rate shown by the two corrected annual means.

TABLE 27—*continued.*

Constants.	Month.			X	s	$X\frac{a}{dv}\frac{dX}{X}$ (calculated) $=\frac{dX}{ds}$	$\frac{dX}{di}$	Constants.	Month.			X	s	$X\frac{a}{dv}\frac{dX}{X}$ (calculated) $=\frac{dX}{ds}$	$\frac{dX}{di}$
$\frac{a}{dv}\frac{dX}{X}$ = ·0009768 1 ; $a\,\sin^2\theta$ = ·0000095416.	February (24th to 28th)	1886.		3·7406	32·10	·00364	·01261	$\frac{a}{dv}\frac{dX}{X}$ = ·0009768 1 ; $a\,\sin^2\theta$ = ·0000095416.	October ...	1887.		3·7397	26·19	·00366	·01268
	March ...	„		3·7406	31·45	·00365	·01262		November ...	„		3·7397	26·02	·00366	·01268
	April ...	„		3·7406	30·82	·00365	·01262		December ...	„		3·7396	25·71	·00367	·01268
	May ...	„		3·7406	30·42	·00365	·01263		January ...	1888.		3·7408	25·33	·00367	·01269
	June ...	„		3·7405	30·28	·00365	·01263		February ...	„		3·7408	25·34	·00367	·01269
	July ...	„		3·7405	30·06	·00365	·01263		March ...	„		3·7409	25·14	·00367	·01270
	August ...	„		3·7405	29·76	·00365	·01264		April ...	„		3·7409	24·70	·00367	·01270
	September ...	„		3·7405	29·60	·00365	·01264		May ...	„		3·7409	24·19	·00367	·01271
	October ...	„		3·7404	29·12	·00365	·01264		June ...	„		3·7410	35·73	·00363	·01256
	November ...	„		3·7404	28·92	·00366	·01265		July ...	„		3·7410	35·63	·00363	·01257
	December ...	„		3·7404	28·68	·00366	·01265		August ...	„		3·7410	35·41	·00363	·01257
	January ...	1887.		3·7401	28·62	·00366	·01265		September ...	„		3·7410	35·12	·00363	·01257
	February ...	„		3·7401	28·39	·00366	·01265		October ...	„		3·7411	34·85	·00363	·01258
	March ...	„		3·7400	28·29	·00366	·01265		November ...	„		3·7411	34·48	·00364	·01258
	April ...	„		3·7400	27·80	·00366	·01266		December ...	„		3·7411	34·45	·00364	·01258
	May ...	„		3·7399	27·36	·00366	·01266		January ...	1889.		3·7422	34·39	·00364	·01259
	June ...	„		3·7399	27·20	·00366	·01267		February ...	„		3·7423	34·23	·00364	·01259
	July ...	„		3·7399	27·12	·00366	·01267		March ...	„		3·7424	33·71	·00364	·01259
	August ...	„		3·7398	26·72	·00366	·01267		April ...	„		3·7424	33·67	·00364	·01259
	September ...	„		3·7398	26·31	·00366	·01268								

Appendix I, 1879—82, paragraph 109. Since the 24th May 1880 the horizontal force magnetograph has been under the natural pressure of the atmosphere.

TEMPERATURE COEFFICIENT OF THE HORIZONAL FORCE MAGNETOGRAPH.

See Appendix I, 1879—82, paragraphs 110 to 113 and Appendix VI, 1886, paragraph 63.

DECLINATION MAGNETOGRAPH.

59. Appendix I, 1879—82, paragraphs 114 to 117. The enclosure of the declination magnetograph has not been opened since the 18th July 1876, and the air in it has remained under artificial pressure till now (January 1890), the pressure at the beginning of the period having been 2·28 inches of mercury, and having now declined to 2·22 inches.

60. Appendix I, 1879—82, paragraph 118. In the observations given in the foregoing pages, observers have been designated by their several initials: the corresponding names are as follows:—

V. N.	...	...	... Vinayek Narayen.
P. ...	...	...	... Purshram Luxuman.
V. D.	...	...	... Vishnu Damodar.
V. G. G.	...	...	... Vithal Govind.
K. ...	...	...	... Krishnaji Govind.
G. S. J.	...	...	... Ganesh Sadashiv.
D. ...	...	...	... Damodar Vaman.
G. ...	...	...	... Govind Narayen.

APPENDIX II.

The solar diurnal variations of Declination, Horizontal Force and Vertical Force at Bombay, as derived from the registrations of the Cola'ba Magnetographs.

[Continuation of Appendix IV to the Bombay Magnetical and Meteorological Observations, 1879—82.]

61. Appendix IV, 1879—82, paragraph 251. The data used for this investigation are the entries on the monthly abstracts described in Appendix I, 1879—82, paragraph 17—of declination from May 1882 to December 1888, of horizontal force from May 1880 to December 1888, and of vertical force from May 1879 to December 1888.* The variations were taken of the mean hourly tabulations at the foot of each abstract, and these were then converted into force by means of the coefficients of Table 16 (paragraph 37), Table 27 (paragraph 58) and those described in Appendix I, 1879—82, paragraph 117. It is these converted variations, and averages of groups of them, that are entered in Tables 28 to 56, and curved on Plates II to VI. For February 1880 the progressive change of scale-reading, following immediately upon a new adjustment of the vertical force magnetograph, was so great as sensibly to distort the curve, and another curve (Fig. 206*a*) was constructed from the variations given after elimination of the progressive change.

TABLE 28.—DECLINATION MAGNETOGRAPH.

Showing the mean diurnal variation of Declination for each month of the year 1882 and for the whole year.

1882. Bombay Civil Time.		MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h.	m.													
10	18 ...	+·00075	+·00109	+·00112	+·00059	−·00031	+·00002	−·00003	−·00040	−·00027	−·00062	−·00014	+·00029	+·00017
11	18 ...	−·00003	+·00012	−·00006	−·00094	−·00165	−·00142	−·00118	−·00171	−·00141	−·00155	−·00066	−·00008	−·00088
12	18 ...	−·00012	−·00065	−·00134	−·00206	−·00246	−·00214	−·00170	−·00241	−·00215	−·00160	−·00039	−·00002	−·00142
13	18 ...	+·00012	−·00072	−·00153	−·00209	−·00236	−·00207	−·00160	−·00233	−·00192	−·00084	+·00033	+·00030	−·00123
14	18 ...	+·00019	−·00056	−·00094	−·00131	−·00182	−·00151	−·00112	−·00194	−·00108	−·00001	+·00053	+·00031	−·00077
15	18 ...	+·00019	−·00025	−·00006	−·00056	−·00092	−·00101	−·00062	−·00123	−·00023	+·00062	+·00055	+·00031	−·00027
16	18 ...	+·00019	−·00012	+·00025	−·00012	−·00013	−·00063	−·00034	−·00047	+·00012	+·00058	+·00040	+·00032	·00000
17	18 ...	−·00006	−·00022	−·00016	−·00009	+·00022	−·00040	−·00029	+·00004	−·00007	−·00023	+·00021	+·00009	−·00008
18	18 ...	−·00012	−·00034	−·00047	−·00022	+·00008	−·00034	−·00025	+·00009	−·00030	−·00015	+·00020	+·00015	−·00014
19	18 ...	+·00006	+·00003	−·00031	−·00025	−·00039	−·00074	−·00066	−·00021	−·00034	−·00002	+·00008	+·00025	−·00021
20	18 ...	+·00003	+·00006	−·00019	−·00025	−·00042	−·00064	−·00058	−·00023	−·00014	+·00003	+·00014	+·00017	−·00017
21	18 ...	−·00006	+·00003	−·00009	−·00012	−·00024	−·00051	−·00045	−·00010	−·00006	+·00006	+·00008	+·00017	−·00011
22	18 ...	·00000	+·00006	+·00006	+·00003	−·00005	−·00021	−·00024	+·00016	+·00002	+·00018	+·00017	+·00019	+·00003
23	18 ...	·00000	+·00016	+·00016	+·00012	+·00012	+·00008	−·00006	+·00027	+·00017	+·00028	+·00039	+·00024	+·00016
0	18 ...	+·00006	+·00019	+·00019	+·00028	+·00032	+·00034	+·00016	+·00037	+·00027	+·00021	+·00026	+·00025	+·00024
1	18 ...	+·00003	+·00012	+·00016	+·00041	+·00039	+·00052	+·00030	+·00042	+·00027	+·00023	+·00030	+·00013	+·00027
2	18 ...	+·00003	+·00006	+·00012	+·00037	+·00052	+·00058	+·00030	+·00040	+·00026	+·00016	+·00012	+·00001	+·00024
3	18 ...	−·00016	−·00009	·00000	+·00022	+·00056	+·00056	+·00038	+·00032	+·00013	−·00007	−·00022	−·00013	+·00012
4	18 ...	−·00037	−·00022	−·00012	+·00012	+·00047	+·00053	+·00045	+·00031	+·00007	−·00008	−·00048	−·00034	+·00003
5	18 ...	−·00059	−·00037	−·00022	+·00009	+·00066	+·00095	+·00074	+·00055	+·00015	−·00004	−·00060	−·00050	+·00007
6	18 ...	−·00069	−·00041	−·00016	+·00075	+·00187	+·00203	+·00168	+·00178	+·00119	+·00047	−·00107	−·00070	+·00056
7	18 ...	−·00069	−·00025	+·00050	+·00162	+·00241	+·00254	+·00205	+·00267	+·00217	+·00113	−·00068	−·00100	+·00104
8	18 ...	+·00019	+·00072	+·00134	+·00203	+·00211	+·00217	+·00187	+·00245	+·00210	+·00098	+·00023	−·00053	+·00130
9	18 ...	+·00100	+·00128	+·00159	+·00175	+·00102	+·00124	+·00117	+·00121	+·00166	+·00032	+·00023	+·00010	+·00100

* For convenience of reference the variations are reprinted for the months January to April—of declination for the year 1882, of horizontal force for 1880, and of vertical force for 1879.

Table 29.—Declination Magnetograph.

Showing the mean diurnal variation of Declination for each month of the year 1883 and for the whole year.

1883. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 18 ...	+·00081	+·00090	+·00087	+·00005	−·00076	−·00052	−·00031	−·00031	−·00065	+·00021	−·00036	−·00007	−·00001
11 18 ...	−·00040	+·00030	−·00027	−·00146	−·00209	−·00179	−·00162	−·00125	−·00209	−·00092	−·00086	−·00074	−·00110
12 18 ...	−·00096	−·00028	−·00107	−·00223	−·00265	−·00260	−·00228	−·00198	−·00276	−·00144	−·00045	−·00062	−·00161
13 18 ...	−·00059	−·00031	−·00112	−·00186	−·00224	−·00256	−·00241	−·00229	−·00228	−·00109	+·00046	−·00019	−·00137
14 18 ...	−·00025	−·00041	−·00050	−·00109	−·00139	−·00192	−·00207	−·00188	−·00119	−·00048	+·00067	+·00004	−·00087
15 18 ...	+·00007	−·00026	+·00012	−·00025	−·00053	−·00104	−·00116	−·00088	−·00011	+·00012	+·00051	+·00026	−·00026
16 18 ...	+·00026	−·00025	+·00021	+·00024	+·00009	−·00025	−·00028	−·00004	+·00053	+·00019	+·00025	+·00026	+·00010
17 18 ...	−·00007	−·00027	−·00013	+·00014	+·00019	+·00005	+·00018	+·00025	+·00036	−·00033	−·00015	−·00025	·00000
18 18 ...	·00000	−·00028	−·00033	−·00033	−·00012	−·00004	+·00017	+·00006	−·00025	−·00041	−·00007	−·00004	−·00014
19 18 ...	+·00018	−·00009	−·00028	−·00050	−·00035	−·00044	−·00041	−·00037	−·00030	−·00024	+·00006	+·00013	−·00022
20 18 ...	+·00019	+·00008	−·00014	−·00037	−·00031	−·00044	−·00040	−·00033	−·00033	−·00016	+·00005	+·00007	−·00017
21 18 ...	+·00011	+·00016	−·00007	−·00022	−·00013	−·00025	−·00037	−·00024	−·00026	−·00013	+·00002	−·00001	−·00012
22 18 ...	+·00012	+·00023	−·00005	−·00007	+·00002	−·00006	−·00017	−·00013	−·00015	+·00006	+·00012	+·00005	·00000
23 18 ...	+·00018	+·00026	+·00004	−·00001	+·00016	+·00012	−·00002	−·00002	+·00004	+·00025	+·00026	+·00016	+·00012
0 18 ...	+·00024	+·00030	+·00021	+·00013	+·00025	+·00023	+·00017	+·00012	+·00018	+·00030	+·00023	+·00026	+·00022
1 18 ...	+·00017	+·00035	+·00020	+·00026	+·00036	+·00030	+·00034	+·00021	+·00023	+·00027	+·00024	+·00025	+·00026
2 18 ...	+·00009	+·00029	+·00017	+·00031	+·00040	+·00039	+·00040	+·00027	+·00020	+·00026	+·00014	+·00018	+·00026
3 18 ...	−·00012	+·00015	+·00003	+·00023	+·00040	+·00047	+·00036	+·00026	+·00014	+·00007	−·00003	·00000	+·00016
4 18 ...	−·00032	−·00017	−·00010	+·00020	+·00042	+·00060	+·00046	+·00030	+·00019	−·00011	−·00024	−·00022	+·00008
5 18 ...	−·00044	−·00048	−·00014	+·00036	+·00078	+·00106	+·00093	+·00060	+·00041	−·00019	−·00035	−·00044	+·00017
6 18 ...	−·00050	−·00065	−·00022	+·00113	+·00192	+·00234	+·00217	+·00176	+·00171	+·00009	−·00046	−·00037	+·00074
7 18 ...	−·00039	−·00067	+·00034	+·00195	+·00249	+·00291	+·00278	+·00256	+·00290	+·00104	−·00032	−·00032	+·00127
8 18 ...	+·00044	+·00018	+·00099	+·00199	+·00216	+·00244	+·00238	+·00225	+·00250	+·00152	+·00013	+·00053	+·00146
9 18 ...	+·00116	+·00090	+·00125	+·00138	+·00090	+·00096	+·00119	+·00107	+·00098	+·00108	+·00014	+·00106	+·00101

TABLE 30.—DECLINATION MAGNETOGRAPH.

Showing the mean diurnal variation of Declination for each month of the year 1884 and for the whole year.

1884. Bombay Civil Time.			MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h.	m.														
10	18	...	+·00127	+·00204	+·00078	+·00015	−·00107	−·00073	−·00054	−·00116	−·00045	+·00005	+·00079	+·00087	+·00017
11	18	...	+·00014	+·00119	−·00049	−·00164	−·00235	−·00203	−·00176	−·00266	−·00215	−·00092	+·00004	+·00023	−·00103
12	18	...	−·00036	+·00025	−·00144	−·00270	−·00267	−·00262	−·00225	−·00295	−·00311	−·00126	−·00019	+·00005	−·00160
13	18	...	−·00038	−·00024	−·00151	−·00255	−·00211	−·00240	−·00221	−·00261	−·00282	−·00103	+·00008	+·00008	−·00147
14	18	...	−·00031	−·00067	−·00071	−·00170	−·00106	−·00168	−·00147	−·00173	−·00162	−·00034	−·00015	−·00014	−·00096
15	18	...	−·00010	−·00071	−·00005	−·00060	−·00018	−·00085	−·00069	−·00051	−·00032	+·00015	−·00021	−·00028	−·00036
16	18	...	+·00001	−·00055	+·00019	+·00022	+·00037	−·00008	−·00014	+·00042	+·00050	+·00034	+·00011	−·00012	+·00011
17	18	...	−·00023	−·00050	−·00020	+·00028	+·00039	+·00030	+·00017	+·00060	+·00048	−·00014	+·00001	−·00004	+·00009
18	18	...	−·00039	−·00058	−·00057	−·00006	+·00011	+·00010	+·00006	+·00017	−·00002	−·00025	+·00008	+·00002	−·00011
19	18	...	−·00004	−·00014	−·00034	−·00029	−·00031	−·00042	−·00047	−·00013	−·00008	−·00012	+·00018	+·00018	−·00016
20	18	...	−·00002	·00000	−·00020	−·00026	−·00031	−·00040	−·00053	−·00034	−·00008	−·00006	+·00025	+·00018	−·00015
21	18	...	−·00007	−·00004	−·00018	−·00019	−·00020	−·00026	−·00052	−·00031	−·00005	−·00004	+·00023	+·00019	−·00012
22	18	...	−·00005	−·00007	−·00013	·00000	−·00010	−·00009	−·00031	−·00019	+·00005	+·00014	+·00024	+·00020	−·00003
23	18	...	−·00001	+·00009	+·00002	+·00016	+·00003	+·00004	−·00013	−·00005	+·00017	+·00023	+·00026	+·00025	+·00009
0	18	...	+·00002	+·00017	+·00008	+·00032	+·00019	+·00018	+·00003	+·00004	+·00028	+·00023	+·00024	+·00026	+·00017
1	18	...	+·00008	+·00017	+·00014	+·00037	+·00031	+·00027	+·00019	+·00016	+·00027	+·00020	+·00017	+·00016	+·00021
2	18	...	+·00006	+·00005	+·00009	+·00029	+·00033	+·00033	+·00032	+·00028	+·00034	+·00012	+·00004	−·00002	+·00019
3	18	...	−·00016	−·00011	−·00007	+·00012	+·00030	+·00036	+·00041	+·00037	+·00027	−·00002	−·00021	−·00016	+·00009
4	18	...	−·00039	−·00038	−·00023	+·00003	+·00035	+·00054	+·00058	+·00052	+·00020	−·00017	−·00043	−·00047	+·00001
5	18	...	−·00063	−·00070	−·00023	+·00010	+·00061	+·00104	+·00113	+·00093	+·00040	−·00029	−·00076	−·00072	+·00007
6	18	...	−·00065	−·00074	+·00026	+·00126	+·00190	+·00241	+·00220	+·00246	+·00152	−·00002	−·00111	−·00093	+·00071
7	18	...	−·00034	−·00067	+·00123	+·00244	+·00258	+·00287	+·00276	+·00329	+·00254	+·00085	−·00079	−·00095	+·00132
8	18	...	+·00083	+·00047	+·00197	+·00255	+·00219	+·00236	+·00227	+·00265	+·00244	+·00140	+·00028	+·00004	+·00162
9	18	...	+·00175	+·00164	+·00161	+·00167	+·00073	+·00076	+·00088	+·00076	+·00122	+·00094	+·00084	+·00115	+·00116

TABLE 31.—DECLINATION MAGNETOGRAPH.

Showing the mean diurnal variation of Declination for each month of the year 1885 and for the whole year.

1885. Bombay Civil Time.			MONTH.											Year.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.													
10	18	...	+·00128	−·00011	+·00078	+·00049	−·00080	−·00079	−·00057	−·00145	−·00083	+·00014	−·00011	+·00039	−·00013
11	18	...	+·00008	−·00066	−·00004	−·00107	−·00211	−·00198	−·00179	−·00269	−·00226	−·00068	−·00056	+·00001	−·00115
12	18	...	−·00041	−·00076	−·00123	−·00218	−·00267	−·00267	−·00250	−·00311	−·00279	−·00122	−·00037	+·00024	−·00164
13	18	...	−·00001	−·00020	−·00174	−·00220	−·00224	−·00262	−·00251	−·00255	−·00245	−·00083	+·00017	+·00050	−·00139
14	18	...	+·00016	+·00026	−·00107	−·00136	−·00131	−·00194	−·00184	−·00147	−·00139	−·00031	+·00048	+·00028	−·00079
15	18	...	+·00024	+·00054	+·00013	−·00046	−·00047	−·00104	−·00076	−·00015	−·00024	+·00020	+·00048	+·00017	−·00011
16	18	...	+·00047	+·00058	+·00064	+·00004	+·00012	−·00018	+·00006	+·00081	+·00052	+·00028	+·00037	+·00024	+·00033
17	18	...	+·00017	+·00009	+·00028	−·00002	+·00038	+·00017	+·00031	+·00087	+·00026	−·00018	+·00014	+·00009	+·00021
18	18	...	−·00003	−·00012	−·00026	−·00023	+·00003	+·00016	−·00005	+·00010	−·00018	−·00015	+·00015	+·00016	−·00003
19	18	...	+·00013	+·00006	−·00020	−·00030	−·00034	−·00026	−·00053	−·00032	−·00010	−·00007	+·00019	+·00026	−·00012
20	18	...	+·00007	+·00008	−·00013	−·00021	−·00029	−·00026	−·00051	−·00033	−·00005	+·00006	+·00019	+·00019	−·00010
21	18	...	+·00003	+·00006	+·00003	−·00008	−·00020	−·00017	−·00040	−·00031	−·00003	+·00008	+·00026	+·00019	−·00004
22	18	...	+·00012	+·00007	·00000	+·00016	−·00005	−·00008	−·00025	−·00022	+·00002	+·00025	+·00028	+·00020	+·00004
23	18	...	+·00017	+·00009	+·00012	+·00026	+·00008	+·00008	−·00010	−·00022	+·00021	+·00027	+·00033	+·00018	+·00012
0	18	...	+·00017	+·00008	+·00019	+·00028	+·00025	+·00023	+·00005	−·00011	+·00015	+·00028	+·00035	+·00009	+·00017
1	18	...	+·00002	+·00017	+·00018	+·00030	+·00035	+·00040	+·00022	−·00001	+·00035	+·00025	+·00029	+·00005	+·00021
2	18	...	−·00011	+·00012	+·00012	+·00033	+·00034	+·00051	+·00032	+·00014	+·00033	+·00019	+·00017	−·00008	+·00020
3	18	...	−·00040	+·00002	+·00004	+·00022	+·00034	+·00054	+·00048	+·00032	+·00028	+·00008	−·00007	−·00023	+·00013
4	18	..	−·00070	−·00012	−·00003	+·00011	+·00038	+·00068	+·00057	+·00047	+·00030	−·00010	−·00033	−·00042	+·00007
5	18	...	−·00090	−·00020	−·00011	+·00010	+·00069	+·00108	+·00109	+·00111	+·00052	−·00020	−·00052	−·00064	+·00017
6	18	...	−·00100	−·00023	−·00013	+·00078	+·00205	+·00237	+·00238	+·00262	+·00159	−·00017	−·00086	−·00091	+·00071
7	18	..	−·00096	−·00016	+·00049	+·00165	+·00251	+·00271	+·00282	+·00336	+·00254	+·00043	−·00079	−·00109	+·00113
8	18	...	+·00007	+·00019	+·00097	+·00185	+·00211	+·00230	+·00241	+·00261	+·00231	+·00080	−·00026	−·00041	+·00125
9	18	...	+·00132	+·00014	+·00101	+·00152	+·00086	+·00078	+·00109	+·00050	+·00092	+·00062	+·00005	+·00048	+·00077

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TABLE 32.—DECLINATION MAGNETOGRAPH.

Showing the mean diurnal variation of declination for each month of the year 1886 and for the whole year.

1886.			MONTH.											Year.
Bombay Civil Time.			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.													
10	18	...	+·00113	+·00099	+·00048	+·00008	−·00096	·00000	+·00001	−·00060	−·00054	−·00001	−·00072	−·00001	−·00001
11	18	...	+·00051	+·00070	−·00044	−·00123	−·00198	−·00131	−·00102	−·00184	−·00187	−·00118	−·00089	−·00004	−·00088
12	18	...	−·00002	+·00043	−·00108	−·00191	−·00244	−·00218	−·00158	−·00245	−·00261	−·00165	−·00045	−·00004	−·00133
13	18	...	−·00002	+·00038	−·00116	−·00183	−·00218	−·00217	−·00182	−·00231	−·00242	−·00124	+·00033	+·00021	−·00119
14	18	...	−·00001	+·00009	−·00062	−·00134	−·00127	−·00168	−·00157	−·00159	−·00146	−·00049	+·00062	+·00033	−·00075
15	18	...	−·00007	−·00027	+·00008	−·00061	−·00044	−·00103	−·00106	−·00063	−·00035	+·00019	+·00059	+·00041	−·00027
16	18	...	+·00006	−·00038	+·00019	+·00003	+·00013	−·00057	−·00062	+·00013	+·00028	+·00043	+·00050	+·00061	+·00007
17	18	...	+·00012	−·00025	·00000	·00000	+·00015	−·00030	−·00029	+·00042	+·00025	+·00009	+·00032	+·00053	+·00009
18	18	...	+·00018	−·00014	−·00031	−·00031	−·00019	−·00027	−·00031	−·00001	−·00013	−·00005	+·00047	+·00051	−·00005
19	18	...	+·00034	·00000	−·00015	−·00033	−·00051	−·00055	−·00066	−·00028	−·00017	·00000	+·00025	+·00043	−·00014
20	18	...	+·00027	+·00005	−·00011	−·00030	−·00040	−·00056	−·00067	−·00038	−·00011	+·00005	+·00022	+·00032	−·00013
21	18	...	+·00021	+·00012	−·00011	−·00008	−·00024	−·00041	−·00048	−·00028	+·00007	+·00017	+·00035	+·00027	−·00003
22	18	...	+·00023	+·00017	·00000	+·00006	−·00010	−·00022	−·00032	−·00016	+·00022	+·00029	+·00034	+·00024	+·00006
23	18	..	+·00030	+·00027	+·00018	+·00024	+·00009	+·00001	−·00006	−·00002	+·00029	+·00037	+·00034	+·00023	+·00019
0	18	...	+·00018	+·00026	+·00017	+·00033	+·00021	+·00024	+·00011	+·00013	+·00046	+·00030	+·00032	+·00018	+·00024
1	18	...	−·00003	+·00022	+·00026	+·00036	+·00042	+·00038	+·00031	+·00026	+·00047	+·00037	+·00025	+·00016	+·00029
2	18	...	−·00017	+·00006	+·00020	+·00029	+·00048	+·00046	+·00041	+·00036	+·00046	+·00016	+·00021	−·00004	+·00024
3	18	...	−·00033	−·00021	+·00001	+·00024	+·00047	+·00048	+·00044	+·00037	+·00045	+·00008	−·00003	−·00025	+·00014
4	18	...	−·00053	−·00041	−·00008	+·00016	+·00052	+·00052	+·00048	+·00048	+·00042	−·00009	−·00033	−·00042	+·00006
5	18	...	−·00079	−·00067	−·00025	+·00019	+·00100	+·00083	+·00076	+·00080	+·00046	−·00027	−·00043	−·00070	+·00008
6	18	...	−·00101	−·00089	·00000	+·00107	+·00211	+·00191	+·00196	+·00204	+·00134	−·00002	−·00062	−·00085	+·00059
7	18	..	−·00112	−·00097	+·00059	+·00189	+·00250	+·00260	+·00255	+·00264	+·00206	+·00073	−·00068	−·00120	+·00097
8	18	...	−·00020	−·00022	+·00110	+·00186	+·00203	+·00240	+·00223	+·00214	+·00178	+·00105	−·00048	−·00073	+·00108
9	18	...	+·00077	+·00069	+·00103	+·00114	+·00055	+·00143	+·00119	+·00075	+·00068	+·00071	−·00052	−·00014	+·00069

Table 33.—Declination Magnetograph.

Showing the mean diurnal variation of declination for each month of the year 1887 and for the whole year.

1887. Bombay Civil Time.			MONTH.											Year.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.														
10	18	...	+·00092	+·00050	+·00082	+·00012	−·00138	−·00046	−·00054	−·00103	−·00113	−·00039	−·00037	+·00041	−·00021
11	18	...	−·00015	+·00016	−·00024	−·00117	−·00220	−·00170	−·00185	−·00250	−·00233	−·00129	−·00069	+·00022	−·00114
12	18	...	−·00061	−·00017	−·00101	−·00205	−·00260	−·00231	−·00250	−·00290	−·00280	−·00138	−·00015	+·00032	−·00151
13	18	...	−·00050	−·00014	−·00094	−·00194	−·00209	−·00201	−·00245	−·00256	−·00229	−·00090	+·00053	+·00039	−·00124
14	18	...	−·00037	·00000	−·00032	−·00125	−·00121	−·00149	−·00171	−·00160	−·00099	−·00022	+·00067	+·00030	−·00068
15	18	...	−·00019	+·00019	+·00026	−·00049	−·00040	−·00088	−·00085	−·00040	+·00027	+·00044	+·00052	+·00001	−·00013
16	18	...	+·00017	+·00025	+·00025	+·00002	+·00026	−·00029	−·00008	+·00053	+·00098	+·00068	+·00040	+·00014	+·00028
17	18	...	+·00032	+·00007	−·00013	−·00001	+·00039	+·00001	+·00018	+·00072	+·00068	+·00026	+·00016	+·00027	+·00024
18	18	...	+·00026	+·00011	−·00034	−·00028	−·00012	−·00001	−·00002	+·00002	+·00010	+·00008	+·00021	+·00035	+·00003
19	18	...	+·00039	+·00010	−·00027	−·00030	−·00025	−·00032	−·00043	−·00024	+·00001	+·00001	+·00021	+·00031	−·00006
20	18	...	+·00028	+·00009	−·00018	−·00020	−·00019	−·00028	−·00033	−·00013	−·00006	−·00002	+·00017	+·00029	−·00005
21	18	...	+·00020	+·00012	−·00011	−·00007	−·00010	−·00018	−·00025	−·00010	−·00004	+·00003	+·00022	+·00029	·00000
22	18	...	+·00020	+·00014	−·00002	+·00007	+·00005	−·00007	−·00012	−·00009	−·00002	+·00014	+·00022	+·00025	+·00006
23	18	...	+·00024	+·00028	+·00004	+·00015	+·00023	+·00011	+·00006	+·00001	−·00001	+·00029	+·00036	+·00021	+·00016
0	18	...	+·00016	+·00019	+·00010	+·00030	+·00037	+·00026	+·00020	+·00008	−·00001	+·00033	+·00035	+·00019	+·00021
1	18	...	+·00007	+·00011	+·00006	+·00033	+·00047	+·00038	+·00035	+·00008	+·00008	+·00032	+·00028	+·00016	+·00022
2	18	...	−·00006	+·00002	−·00008	+·00040	+·00056	+·00046	+·00046	+·00019	+·00015	+·00018	+·00011	−·00003	+·00020
3	18	...	−·00022	−·00002	−·00020	+·00027	+·00055	+·00050	+·00043	+·00025	+·00022	+·00008	−·00009	−·00028	+·00012
4	18	...	−·00037	−·00025	−·00034	+·00019	+·00061	+·00051	+·00055	+·00048	+·00034	−·00007	−·00033	−·00048	+·00007
5	18	...	−·00067	−·00052	−·00040	+·00020	+·00090	+·00083	+·00090	+·00095	+·00064	−·00012	−·00052	−·00072	+·00012
6	18	...	−·00080	−·00065	−·00021	+·00084	+·00196	+·00183	+·00207	+·00226	+·00156	−·00007	−·00080	−·00090	+·00059
7	18	..	−·00073	−·00072	+·00057	+·00170	+·00231	+·00231	+·00260	+·00292	+·00246	+·00053	−·00078	−·00113	+·00100
8	18	...	+·00029	−·00024	+·00134	+·00189	+·00174	+·00199	+·00232	+·00231	+·00191	+·00076	−·00042	−·00063	+·00110
9	18	...	+·00118	+·00034	+·00139	+·00131	+·00020	+·00080	+·00101	+·00076	+·00032	+·00034	−·00028	+·00008	+·00062

TABLE 34.—DECLINATION MAGNETOGRAPH.

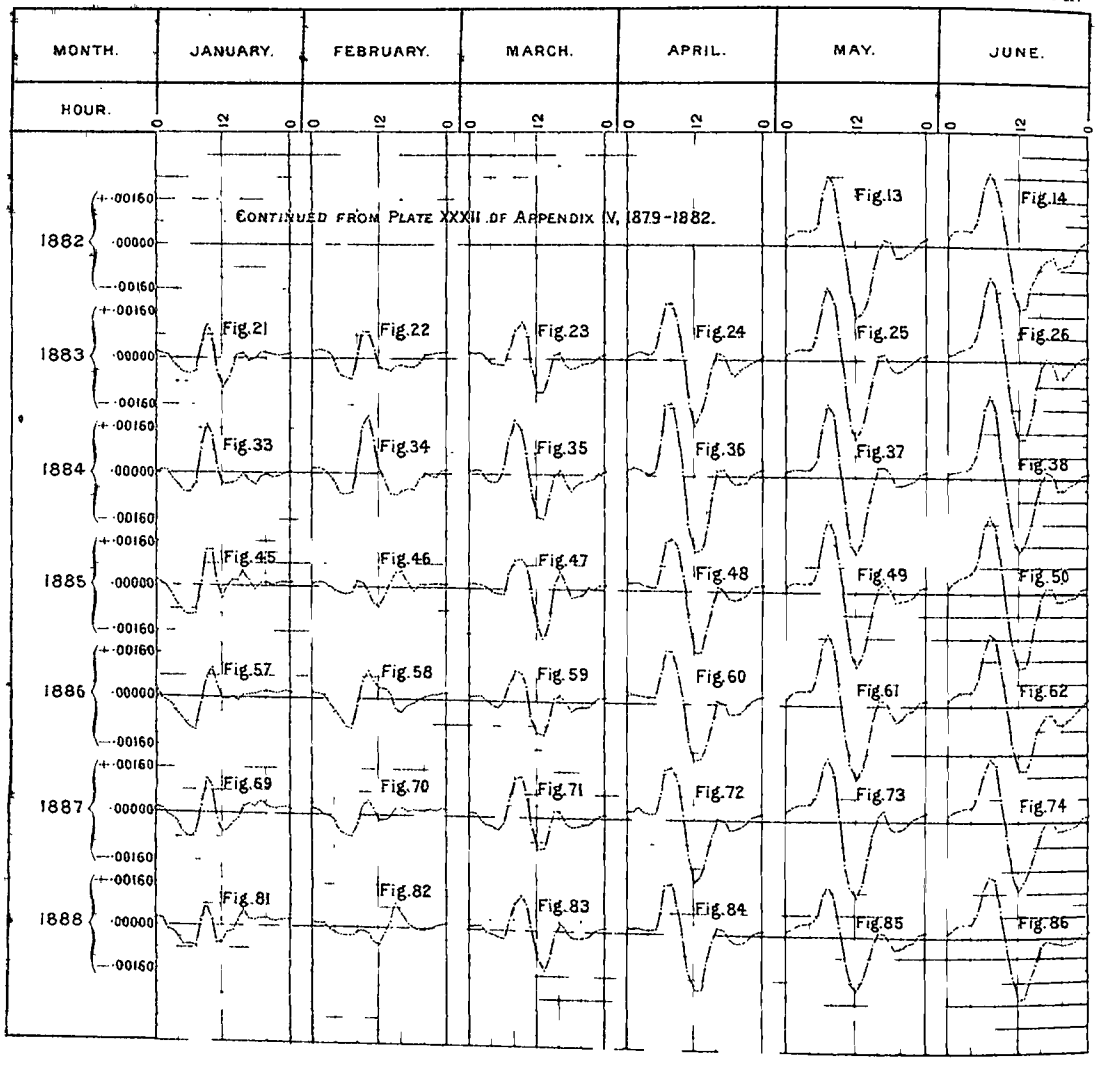
Showing the mean diurnal variation of declination for each month of the year 1888 and for the whole year.

1888. Bombay Civil Time.			MONTH.											Year.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.														
10	18	...	+·00029	−·00016	+·00107	−·00004	−·00085	−·00026	−·00024	−·00068	−·00034	−·00013	−·00041	−·00008	−·00015
11	18	...	−·00064	−·00050	+·00013	−·00123	−·00162	−·00138	−·00161	−·00190	−·00192	−·00102	−·00072	−·00024	−·00105
12	18	...	−·00059	−·00058	−·00093	−·00195	−·00191	−·00230	−·00228	−·00239	−·00247	−·00135	−·00037	−·00022	−·00144
13	18	...	−·00023	−·00019	−·00140	−·00196	−·00154	−·00215	−·00219	−·00221	−·00208	−·00094	+·00020	+·00011	−·00121
14	18	...	−·00011	+·00031	−·00090	−·00110	−·00087	−·00153	−·00172	−·00152	−·00106	−·00027	+·00060	+·00046	−·00064
15	18	...	+·00021	+·00090	−·00006	−·00023	−·00028	−·00096	−·00103	−·00057	−·00015	+·00036	+·00068	+·00049	−·00005
16	18	...	+·00057	+·00064	+·00036	+·00028	+·00009	−·00040	−·00034	+·00022	+·00041	+·00052	+·00049	+·00050	+·00028
17	18	...	+·00027	+·00017	+·00005	+·00017	+·00008	−·00013	+·00002	+·00046	+·00025	+·00017	+·00028	+·00036	+·00018
18	18	...	+·00024	+·00001	−·00018	−·00009	−·00016	−·00022	−·00010	+·00010	−·00009	+·00008	+·00034	+·00037	+·00002
19	18	..	+·00035	−·00003	−·00020	−·00029	−·00043	−·00035	−·00034	−·00024	−·00012	+·00009	+·00022	+·00039	−·00008
20	18	..	+·00036	−·00002	−·00015	−·00032	−·00039	−·00028	−·00041	−·00023	−·00007	+·00007	+·00016	+·00026	−·00008
21	18	...	+·00024	−·00001	−·00008	−·00021	−·00032	−·00022	−·00028	−·00011	−·00006	+·00008	+·00013	+·00023	−·00005
22	18	...	+·00026	+·00005	+·00001	−·00001	−·00011	−·00004	−·00013	−·00010	+·00002	+·00015	+·00013	+·00028	+·00004
23	18	...	+·00029	+·00013	+·00011	+·00006	+·00009	+·00012	+·00007	+·00002	+·00006	+·00027	+·00017	+·00022	+·00013
0	18	...	+·00031	+·00019	+·00013	+·00018	+·00021	+·00024	+·00019	+·00016	+·00017	+·00025	+·00015	+·00020	+·00020
1	18	...	+·00017	+·00012	+·00012	+·00018	+·00037	+·00037	+·00032	+·00018	+·00020	+·00023	+·00010	+·00010	+·00020
2	18	...	−·00011	+·00014	+·00008	+·00026	+·00045	+·00054	+·00041	+·00028	+·00020	+·00011	+·00004	+·00001	+·00020
3	18	...	−·00026	−·00004	−·00005	+·00018	+·00046	+·00048	+·00046	+·00034	+·00011	−·00002	−·00005	−·00018	+·00012
4	18	...	−·00039	−·00018	−·00013	+·00013	+·00052	+·00050	+·00059	+·00042	+·00010	−·00013	−·00024	−·00033	+·00007
5	18	...	−·00071	−·00031	−·00025	+·00018	+·00077	+·00085	+·00090	+·00073	+·00024	−·00022	−·00038	−·00052	+·00011
6	18	...	−·00075	−·00030	−·00033	+·00095	+·00156	+·00175	+·00186	+·00181	+·00114	−·00021	−·00044	−·00066	+·00053
7	18	...	−·00078	−·00026	+·00038	+·00182	+·00193	+·00226	+·00240	+·00239	+·00216	+·00046	−·00056	−·00099	+·00093
8	18	...	+·00018	−·00005	+·00101	+·00189	+·00154	+·00210	+·00229	+·00205	+·00218	+·00088	−·00027	−·00058	+·00110
9	18	..	+·00082	−·00004	+·00125	+·00112	+·00041	+·00103	+·00121	+·00074	+·00111	+·00059	−·00029	−·00014	+·00065

COLABA OBSERVATORY.

DECLINATION MAGNETOGRAPH. DIURNAL VARIATION.

Plate II.



DRAWN & LITHO. GOVT PHOTOZINCO. OFFICE, POONA 1890.

COLABA OBSERVATORY.

DECLINATION MAGNETOGRAPH. DIURNAL VARIATION.

Plate II. *Continued.*

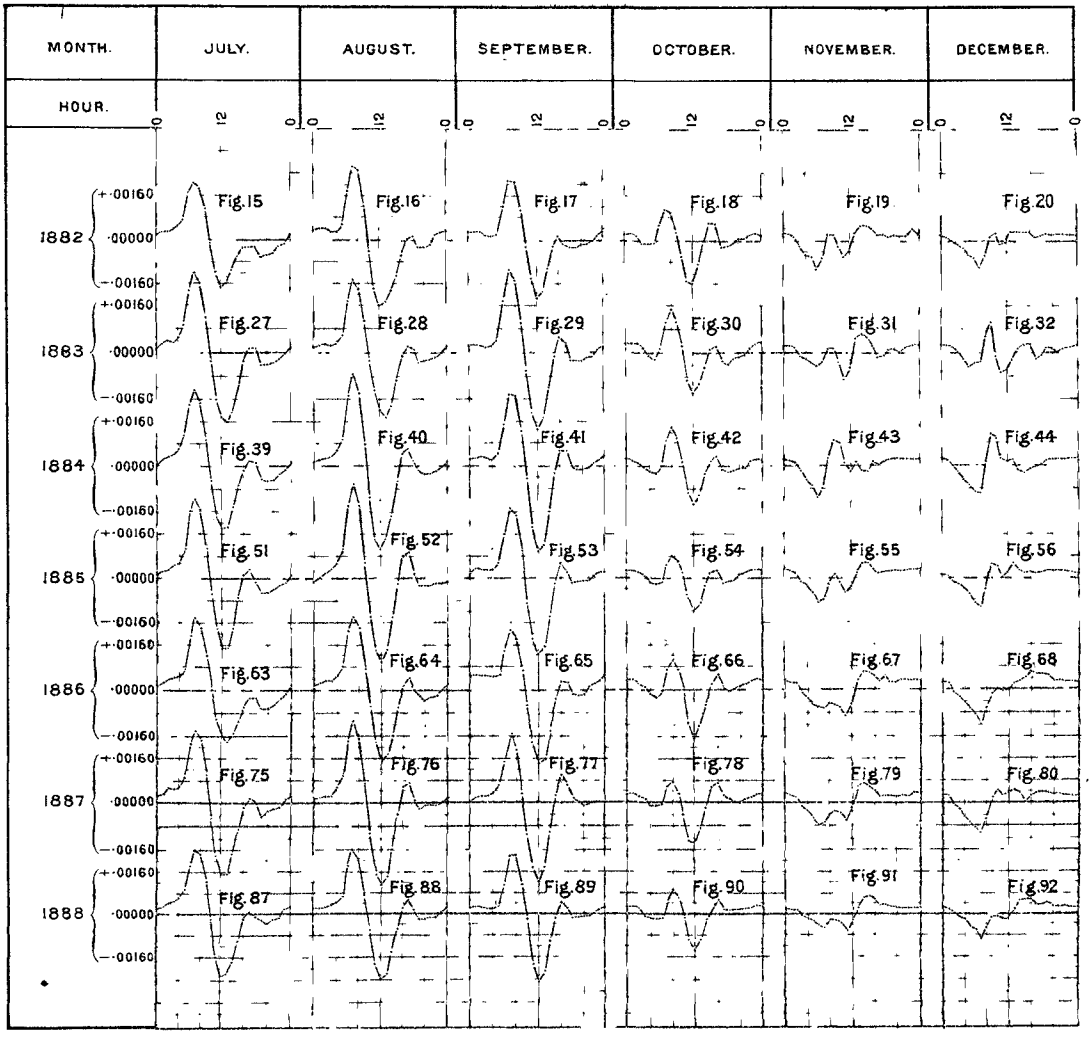


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TABLE 35.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1880 and for the whole year.

1880. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+ ·00215	+ ·00244	+ ·00342	+ ·00342	+ ·00272	+ ·00294	+ ·00231	+ ·00236	+ ·00288	+ ·00336	+ ·00272	+ ·00217	+ ·00274
11 19 ...	+ ·00265	+ ·00274	+ ·00329	+ ·00363	+ ·00290	+ ·00313	+ ·00260	+ ·00291	+ ·00322	+ ·00382	+ ·00268	+ ·00228	+ ·00299
12 19 ...	+ ·00249	+ ·00257	+ ·00266	+ ·00308	+ ·00253	+ ·00279	+ ·00260	+ ·00283	+ ·00276	+ ·00332	+ ·00197	+ ·00190	+ ·00262
13 19 ...	+ ·00173	+ ·00177	+ ·00148	+ ·00224	+ ·00173	+ ·00210	+ ·00210	+ ·00219	+ ·00184	+ ·00195	+ ·00103	+ ·00116	+ ·00178
14 19 ...	+ ·00084	+ ·00084	+ ·00046	+ ·00127	+ ·00077	+ ·00099	+ ·00137	+ ·00128	+ ·00098	+ ·00087	+ ·00044	+ ·00059	+ ·00089
15 19 ...	+ ·00017	+ ·00025	− ·00004	+ ·00025	+ ·00001	− ·00005	+ ·00043	+ ·00047	+ ·00004	− ·00018	− ·00023	+ ·00011	+ ·00010
16 19 ...	− ·00038	− ·00017	− ·00067	− ·00051	− ·00047	− ·00077	− ·00032	− ·00027	− ·00054	− ·00068	− ·00089	− ·00022	− ·00049
17 19 ...	− ·00055	− ·00042	− ·00080	− ·00101	− ·00090	− ·00104	− ·00090	− ·00063	− ·00099	− ·00104	− ·00108	− ·00074	− ·00084
18 19 ...	− ·00072	− ·00055	− ·00093	− ·00118	− ·00108	− ·00123	− ·00122	− ·00146	− ·00109	− ·00128	− ·00095	− ·00096	− ·00105
19 19 ...	− ·00093	− ·00076	− ·00114	− ·00122	− ·00109	− ·00126	− ·00109	− ·00146	− ·00123	− ·00143	− ·00096	− ·00109	− ·00114
20 19 ...	− ·00114	− ·00093	− ·00135	− ·00139	− ·00130	− ·00131	− ·00109	− ·00142	− ·00139	− ·00174	− ·00119	− ·00134	− ·00130
21 19 ...	− ·00118	− ·00101	− ·00139	− ·00135	− ·00134	− ·00131	− ·00104	− ·00160	− ·00142	− ·00164	− ·00139	− ·00134	− ·00133
22 19 ...	− ·00126	− ·00118	− ·00139	− ·00131	− ·00121	− ·00120	− ·00107	− ·00136	− ·00135	− ·00146	− ·00144	− ·00137	− ·00130
23 19 ...	− ·00114	− ·00118	− ·00131	− ·00135	− ·00112	− ·00110	− ·00104	− ·00125	− ·00103	− ·00130	− ·00120	− ·00105	− ·00117
0 19 ...	− ·00105	− ·00110	− ·00127	− ·00127	− ·00093	− ·00097	− ·00107	− ·00107	− ·00085	− ·00118	− ·00102	− ·00093	− ·00106
1 19 ...	− ·00088	− ·00101	− ·00110	− ·00131	− ·00094	− ·00100	− ·00101	− ·00085	− ·00075	− ·00108	− ·00093	− ·00091	− ·00098
2 19 ...	− ·00088	− ·00101	− ·00105	− ·00105	− ·00068	− ·00106	− ·00098	− ·00074	− ·00070	− ·00099	− ·00070	− ·00065	− ·00087
3 19 ...	− ·00084	− ·00093	− ·00080	− ·00097	− ·00070	− ·00095	− ·00095	− ·00062	− ·00053	− ·00071	− ·00064	− ·00059	− ·00077
4 19 ...	− ·00072	− ·00084	− ·00076	− ·00093	− ·00076	− ·00090	− ·00083	− ·00033	− ·00049	− ·00048	− ·00054	− ·00046	− ·00067
5 19 ...	− ·00059	− ·00080	− ·00067	− ·00093	− ·00069	− ·00080	− ·00071	− ·00027	− ·00044	− ·00057	− ·00036	− ·00019	− ·00058
6 19 ...	− ·00034	− ·00055	− ·00055	− ·00063	− ·00049	− ·00039	− ·00040	− ·00036	− ·00057	− ·00063	+ ·00002	+ ·00008	− ·00040
7 19 ...	+ ·00013	− ·00013	+ ·00008	− ·00030	+ ·00003	+ ·00018	+ ·00012	− ·00030	− ·00046	− ·00014	+ ·00079	+ ·00065	+ ·00005
8 19 ...	+ ·00072	+ ·00059	+ ·00127	+ ·00089	+ ·00100	+ ·00111	+ ·00070	+ ·00043	+ ·00033	+ ·00093	+ ·00155	+ ·00128	+ ·00090
9 19 ...	+ ·00135	+ ·00177	+ ·00266	+ ·00232	+ ·00201	+ ·00208	+ ·00149	+ ·00150	+ ·00178	+ ·00226	+ ·00230	+ ·00159	+ ·00193
Average progressive increase *per* day ...	− ·00012	·00000	− ·00005	− ·00015	− ·00004	+ ·00001	− ·00008	− ·00005	+ ·00001	− ·00026	·00000	+ ·00003	− ·00006

Table 36.—Horizontal Force Magnetograph.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1881 and for the whole year.

1881. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00245	+·00283	+·00395	+·00348	+·00342	+·00357	+·00362	+·00301	+·00329	+·00316	+·00333	+·00271	+·00323
11 19 ...	+·00284	+·00329	+·00420	+·00372	+·00356	+·00393	+·00398	+·00363	+·00336	+·00373	+·00323	+·00282	+·00352
12 19 ...	+·00250	+·00295	+·00358	+·00337	+·00315	+·00360	+·00364	+·00347	+·00286	+·00312	+·00247	+·00211	+·00307
13 19 ...	+·00183	+·00204	+·00212	+·00242	+·00229	+·00292	+·00315	+·00286	+·00201	+·00201	+·00127	+·00124	+·00218
14 19 ...	+·00089	+·00081	+·00107	+·00123	+·00130	+·00160	+·00209	+·00163	+·00114	+·00089	+·00037	+·00058	+·00113
15 19 ...	+·00048	−·00003	−·00003	+·00019	+·00039	+·00032	+·00073	+·00040	+·00023	−·00015	−·00028	−·00012	+·00018
16 19 ...	+·00007	−·00059	−·00056	−·00050	−·00068	−·00067	−·00060	−·00047	−·00005	−·00058	−·00096	−·00053	−·00051
17 19 ...	−·00035	−·00080	−·00063	−·00082	−·00111	−·00121	−·00142	−·00076	−·00003	−·00070	−·00113	−·00071	−·00081
18 19 ...	−·00071	−·00108	−·00084	−·00102	−·00130	−·00151	−·00171	−·00096	−·00046	−·00075	−·00110	−·00096	−·00103
19 19 ...	−·00082	−·00118	−·00115	−·00114	−·00141	−·00156	−·00168	−·00131	−·00118	−·00101	−·00129	−·00110	−·00124
20 19 ...	−·00105	−·00128	−·00156	−·00137	−·00139	−·00169	−·00163	−·00140	−·00121	−·00149	−·00139	−·00139	−·00140
21 19 ...	−·00134	−·00141	−·00164	−·00149	−·00143	−·00161	−·00160	−·00137	−·00132	−·00170	−·00130	−·00142	−·00147
22 19 ...	−·00153	−·00170	−·00175	−·00141	−·00140	−·00150	−·00168	−·00135	−·00140	−·00137	−·00127	−·00117	−·00146
23 19 ...	−·00153	−·00145	−·00149	−·00124	−·00136	−·00143	−·00154	−·00132	−·00144	−·00144	−·00127	−·00126	−·00140
0 19 ...	−·00122	−·00127	−·00152	−·00113	−·00132	−·00141	−·00158	−·00129	−·00118	−·00128	−·00092	−·00107	−·00127
1 19 ..	−·00114	−·00113	−·00140	−·00124	−·00133	−·00143	−·00153	−·00129	−·00109	−·00107	−·00085	−·00087	−·00120
2 19 ...	−·00108	−·00102	−·00120	−·00127	−·00126	−·00147	−·00142	−·00125	−·00086	−·00103	−·00085	−·00076	−·00112
3 19 ...	−·00087	−·00086	−·00121	−·00119	−·00121	−·00144	−·00131	−·00119	−·00082	−·00091	−·00078	−·00080	−·00105
4 19 ...	−·00071	−·00072	−·00116	−·00127	−·00121	−·00135	−·00128	−·00105	−·00087	−·00072	−·00063	−·00076	−·00098
5 19 ...	−·00056	−·00062	−·00108	−·00120	−·00109	−·00108	−·00117	−·00094	−·00097	−·00063	−·00063	−·00045	−·00087
6 19 ...	−·00022	−·00040	−·00084	−·00112	−·00070	−·00057	−·00080	−·00085	−·00100	−·00075	−·00032	−·00010	−·00064
7 19 ...	+·00011	+·00013	−·00039	−·00051	+·00020	+·00029	−·00007	−·00053	−·00101	−·00018	+·00054	+·00058	−·00007
8 19 ...	+·00063	+·00118	+·00096	+·00079	+·00138	+·00119	+·00125	+·00047	+·00012	+·00069	+·00130	+·00135	+·00094
9 19 ...	+·00130	+·00225	+·00259	+·00267	+·00257	+·00249	+·00257	+·00182	+·00189	+·00213	+·00246	+·00214	+·00224
Average progressive increase *per* day ...	−·00042	+·00013	−·00008	−·00001	−·00004	−·00004	−·00005	−·00006	−·00009	−·00011	−·00010	−·00001	−·00007

TABLE 37.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1882 and for the whole year.

1882. Bombay Civil Time.	January.	February.	March.	April	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00200	+·00250	+·00398	+·00408	+·00348	+·00329	+·00280	+·00227	+·00273	+·00338	+·00344	+·00241	+·00303
11 19 ...	+·00220	+·00317	+·00460	+·00353	+·00408	+·00335	+·00338	+·00295	+·00308	+·00353	+·00343	+·00277	+·00334
12 19 ...	+·00194	+·00273	+·00423	+·00307	+·00368	+·00287	+·00381	+·00315	+·00289	+·00291	+·00262	+·00228	+·00301
13 19 ...	+·00146	+·00170	+·00282	+·00201	+·00275	+·00223	+·00254	+·00244	+·00239	+·00183	+·00179	+·00136	+·00211
14 19 ...	+·00060	+·00083	+·00139	+·00061	+·00144	+·00116	+·00169	+·00163	+·00126	+·00077	+·00063	+·00043	+·00104
15 19 ...	+·00026	+·00002	+·00012	−·00040	+·00006	+·00046	+·00077	+·00075	+·00038	−·00012	−·00025	−·00016	+·00016
16 19 ...	−·00028	−·00058	−·00050	−·00140	−·00059	−·00036	·00000	−·00021	−·00034	−·00080	−·00175	−·00069	−·00062
17 19 ...	−·00049	−·00069	−·00086	−·00142	−·00100	−·00054	−·00053	−·00054	−·00059	−·00103	−·00190	−·00086	−·00087
18 19 ...	−·00057	−·00079	−·00114	−·00184	−·00126	−·00107	−·00092	−·00096	−·00085	−·00116	−·00227	−·00100	−·00115
19 19 ...	−·00069	−·00089	−·00159	−·00205	−·00135	−·00118	−·00108	−·00118	−·00096	−·00163	−·00205	−·00094	−·00130
20 19 ...	−·00077	−·00089	−·00176	−·00212	−·00145	−·00127	−·00134	−·00138	−·00124	−·00195	−·00231	−·00114	−·00138
21 19 ...	−·00091	−·00127	−·00170	−·00152	−·00145	−·00125	−·00136	−·00127	−·00130	−·00165	−·00119	−·00114	−·00133
22 19 ...	−·00075	−·00120	−·00192	−·00156	−·00148	−·00139	−·00135	−·00149	−·00125	−·00168	−·00154	−·00123	−·00140
23 19 ...	−·00109	−·00144	−·00186	−·00131	−·00140	−·00157	−·00151	−·00133	−·00131	−·00130	−·00129	−·00102	−·00137
0 19 ...	−·00096	−·00114	−·00169	−·00113	−·00136	−·00160	−·00146	−·00136	−·00111	−·00098	−·00108	−·00100	−·00124
1 19 ...	−·00086	−·00108	−·00146	−·00087	−·00115	−·00164	−·00139	−·00117	−·00101	−·00088	−·00104	−·00068	−·00110
2 19 ...	−·00085	−·00090	−·00140	−·00074	−·00119	−·00145	−·00131	−·00100	−·00100	−·00080	−·00059	−·00058	−·00098
3 19 ...	−·00063	−·00087	−·00115	−·00062	−·00124	−·00139	−·00132	−·00087	−·00087	−·00063	−·00038	−·00067	−·00089
4 19 ...	−·00054	−·00077	−·00125	−·00042	−·00118	−·00130	−·00122	−·00048	−·00080	−·00060	−·00029	−·00049	−·00078
5 19 ...	−·00047	−·00062	−·00123	−·00038	−·00109	−·00107	−·00095	−·00055	−·00072	−·00052	−·00042	−·00038	−·00070
6 19 ...	−·00042	−·00049	−·00105	−·00035	−·00099	−·00062	−·00071	−·00061	−·00089	−·00061	+·00037	−·00039	−·00056
7 19 ...	−·00003	−·00003	−·00035	+·00032	−·00034	+·00024	−·00035	−·00045	−·00061	+·00010	+·00087	+·00027	−·00003
8 19 ...	+·00054	+·00088	+·00102	+·00183	+·00081	+·00139	+·00038	+·00016	+·00028	+·00132	+·00166	+·00116	+·00095
9 19 ...	+·00129	+·00188	+·00276	+·00271	+·00225	+·00266	+·00142	+·00149	+·00183	+·00251	+·00253	+·00170	+·00209
Average progressive increase *per* day ...	−·00003	−·00004	−·00004	−·00020	−·00002	−·00002	−·00013	+·00012	−·00006	−·00011	−·00010	·00000	−·00005

TABLE 88.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1883 and for the whole year.

1883. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00203	+·00303	+·00347	+·00397	+·00305	+·00353	+·00334	+·00251	+·00275	+·00362	+·00410	+·00247	+·00316
11 19 ...	+·00263	+·00348	+·00389	+·00424	+·00323	+·00351	+·00383	+·00323	+·00314	+·00439	+·00433	+·00289	+·00357
12 19 ...	+·00250	+·00324	+·00323	+·00366	+·00270	+·00322	+·00345	+·00351	+·00299	+·00389	+·00351	+·00235	+·00319
13 19 ...	+·00174	+·00232	+·00231	+·00263	+·00200	+·00251	+·00304	+·00306	+·00255	+·00266	+·00197	+·00154	+·00236
14 19 ...	+·00095	+·00132	+·00112	+·00162	+·00112	+·00134	+·00181	+·00175	+·00137	+·00115	+·00058	+·00074	+·00124
15 19 ...	+·00024	+·00025	−·00003	+·00066	+·00016	+·00006	+·00072	+·00051	+·00032	+·00033	−·00040	+·00016	+·00025
16 19 ...	−·00031	−·00021	−·00103	−·00023	−·00077	−·00090	−·00057	−·00032	−·00053	−·00049	−·00095	−·00041	−·00056
17 19 ...	−·00056	−·00057	−·00115	−·00122	−·00107	−·00139	−·00120	−·00076	−·00092	−·00062	−·00144	−·00068	−·00096
18 19 ...	−·00067	−·00083	−·00166	−·00150	−·00121	−·00166	−·00153	−·00093	−·00105	−·00082	−·00169	−·00075	−·00119
19 19 ..	−·00083	−·00107	−·00176	−·00174	−·00127	−·00161	−·00154	−·00103	−·00125	−·00112	−·00199	−·00101	−·00135
20 19 ...	−·00101	−·00132	−·00160	−·00176	−·00131	−·00163	−·00122	−·00120	−·00123	−·00150	−·00187	−·00105	−·00139
21 19 ...	−·00103	−·00140	−·00174	−·00192	−·00121	−·00160	−·00137	−·00137	−·00118	−·00156	−·00187	−·00116	−·00145
22 19 ...	−·00119	−·00165	−·00157	−·00168	−·00121	−·00147	−·00146	−·00137	−·00117	−·00178	−·00154	−·00113	−·00143
23 19 ...	−·00112	−·00129	−·00119	−·00139	−·00119	−·00146	−·00160	−·00132	−·00127	−·00166	−·00142	−·00102	−·00133
0 19 ...	−·00093	−·00149	−·00132	−·00137	−·00091	−·00121	−·00155	−·00128	−·00121	−·00155	−·00126	−·00104	−·00126
1 19 ...	−·00088	−·00136	−·00109	−·00156	−·00097	−·00109	−·00159	−·00126	−·00099	−·00141	−·00126	−·00086	−·00119
2 19 ...	−·00081	−·00109	−·00092	−·00142	−·00094	−·00113	−·00140	−·00098	−·00083	−·00143	−·00111	−·00085	−·00108
3 19 ...	−·00088	−·00125	−·00089	−·00127	−·00107	−·00113	−·00123	−·00089	−·00080	−·00111	−·00116	−·00069	−·00103
4 19 ...	−·00083	−·00111	−·00080	−·00126	−·00097	−·00113	−·00112	−·00098	−·00081	−·00115	−·00083	−·00083	−·00098
5 19 ...	−·00070	−·00095	−·00068	−·00117	−·00084	−·00088	−·00090	−·00105	−·00062	−·00119	−·00074	−·00059	−·00086
6 19 ...	−·00041	−·00067	−·00058	−·00109	−·00047	−·00051	−·00055	−·00103	−·00074	−·00122	−·00054	−·00035	−·00068
7 19 ...	+·00004	−·00010	+·00008	−·00028	+·00008	+·00056	−·00015	−·00054	−·00060	−·00054	+·00072	+·00001	−·00006
8 19 ...	+·00069	+·00081	+·00136	+·00120	+·00106	+·00145	+·00082	+·00016	+·00031	+·00075	+·00196	+·00075	+·00094
9 19 ...	+·00135	+·00193	+·00257	+·00287	+·00198	+·00260	+·00195	+·00158	+·00178	+·00237	+·00292	+·00153	+·00212
Average progressive increase *per* day ...	·00000	−·00015	+·00007	−·00005	−·00006	−·00010	−·00014	+·00012	−·00010	+·00001	−·00007	+·00006	−·00003

TABLE 39.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1884 and for the whole year.

1884. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00273	+·00309	+·00455	+·00441	+·00400	+·00372	+·00288	+·00269	+·00233	+·00328	+·00340	+·00240	+·00329
11 19 ...	+·00317	+·00372	+·00514	+·00517	+·00427	+·00394	+·00304	+·00311	+·00298	+·00378	+·00354	+·00254	+·00370
12 19 ...	+·00275	+·00361	+·00455	+·00435	+·00382	+·00359	+·00288	+·00321	+·00292	+·00318	+·00284	+·00199	+·00331
13 19 ...	+·00185	+·00243	+·00311	+·00313	+·00284	+·00264	+·00225	+·00270	+·00222	+·00193	+·00148	+·00102	+·00230
14 19 ...	+·00083	+·00105	+·00141	+·00170	+·00144	+·00120	+·00133	+·00172	+·00122	+·00063	+·00050	+·00001	+·00109
15 19 ...	+·00001	+·00013	+·00015	+·00067	+·00033	+·00013	+·00030	+·00067	+·00045	−·00014	−·00028	−·00055	+·00016
16 19 ...	−·00057	−·00072	−·00090	−·00039	−·00043	−·00079	−·00052	−·00046	−·00008	−·00071	−·00090	−·00086	−·00061
17 19 ...	−·00076	−·00058	−·00087	−·00112	−·00095	−·00128	−·00090	−·00075	−·00044	−·00094	−·00124	−·00080	−·00089
18 19 ...	−·00084	−·00062	−·00101	−·00115	−·00132	−·00151	−·00132	−·00104	−·00067	−·00117	−·00133	−·00074	−·00106
19 19 ...	−·00087	−·00067	−·00148	−·00178	−·00172	−·00171	−·00153	−·00117	−·00100	−·00124	−·00148	−·00077	−·00128
20 19 ...	−·00101	−·00115	−·00185	−·00182	−·00178	−·00183	−·00159	−·00127	−·00115	−·00152	−·00173	−·00093	−·00147
21 19 ...	−·00113	−·00131	−·00196	−·00182	−·00164	−·00181	−·00147	−·00123	−·00124	−·00159	−·00149	−·00099	−·00147
22 19 ...	−·00122	−·00157	−·00209	−·00180	−·00166	−·00172	−·00141	−·00116	−·00121	−·00181	−·00168	−·00101	−·00153
23 19 ...	−·00112	−·00157	−·00195	−·00173	−·00155	−·00157	−·00124	−·00104	−·00107	−·00139	−·00132	−·00092	−·00137
0 19 ...	−·00101	−·00137	−·00164	−·00166	−·00152	−·00148	−·00097	−·00111	−·00103	−·00117	−·00101	−·00097	−·00124
1 19 ...	−·00105	−·00149	−·00179	−·00174	−·00152	−·00144	−·00082	−·00107	−·00083	−·00095	−·00095	−·00077	−·00120
2 19 ...	−·00108	−·00133	−·00173	−·00167	−·00138	−·00135	−·00079	−·00103	−·00092	−·00081	−·00087	−·00049	−·00112
3 19 ...	−·00106	−·00118	−·00157	−·00154	−·00145	−·00121	−·00074	−·00090	−·00088	−·00051	−·00069	−·00057	−·00102
4 19 ...	−·00076	−·00127	−·00138	−·00129	−·00150	−·00109	−·00078	−·00097	−·00073	−·00045	−·00066	−·00037	−·00094
5 19 ...	−·00067	−·00098	−·00138	−·00132	−·00141	−·00092	−·00079	−·00096	−·00060	−·00053	−·00055	−·00014	−·00085
6 19 ...	−·00054	−·00082	−·00121	−·00147	−·00105	−·00049	−·00062	−·00095	−·00079	−·00054	−·00021	+·00006	−·00072
7 19 ...	−·00004	−·00020	−·00051	−·00099	−·00002	+·00050	+·00002	−·00077	−·00079	−·00012	+·00077	+·00050	−·00014
8 19 ...	+·00073	+·00083	+·00118	+·00080	+·00142	+·00164	+·00084	+·00030	−·00006	+·00069	+·00146	+·00097	+·00090
9 19 ...	+·00166	+·00198	+·00321	+·00308	+·00281	+·00286	+·00194	+·00149	+·00139	+·00210	+·00240	+·00139	+·00219
Average progressive increase *per* day ...	−·00001	−·00011	+·00001	+·00003	+·00006	+·00009	−·00004	−·00001	+·00001	−·00003	−·00008	−·00001	−·00001

TABLE 40.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1885 and for the whole year.

1885. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ..	+·00242	+·00296	+·00364	+·00460	+·00332	+·00394	+·00324	+·00265	+·00256	+·00306	+·00283	+·00203	+·00310
11 19 ...	+·00245	+·00356	+·00412	+·00450	+·00316	+·00390	+·00365	+·00273	+·00300	+·00371	+·00311	+·00225	+·00334
12 19 ...	+·00209	+·00354	+·00363	+·00358	+·00266	+·00340	+·00351	+·00273	+·00266	+·00341	+·00260	+·00212	+·00299
13 19 ...	+·00141	+·00257	+·00246	+·00235	+·00193	+·00261	+·00297	+·00198	+·00192	+·00221	+·00171	+·00144	+·00213
14 19 ...	+·00050	+·00145	+·00144	+·00100	+·00114	+·00134	+·00208	+·00119	+·00091	+·00083	+·00074	+·00073	+·00111
15 19 ...	−·00015	+·00071	+·00050	+·00006	+·00021	·00000	+·00075	+·00015	+·00007	−·00027	+·00008	+·00025	+·00020
16 19 ...	−·00061	−·00008	−·00039	−·00066	−·00040	−·00105	−·00056	−·00094	−·00068	−·00082	−·00065	−·00028	−·00059
17 19 ...	−·00068	−·00051	−·00076	−·00107	−·00079	−·00157	−·00121	−·00156	−·00082	−·00101	−·00117	−·00050	−·00097
18 19 ...	−·00095	−·00072	−·00104	−·00142	−·00106	−·00180	−·00139	−·00151	−·00106	−·00103	−·00111	−·00076	−·00115
19 19 ...	−·00102	−·00089	−·00130	−·00153	−·00127	−·00180	−·00152	−·00151	−·00126	−·00145	−·00134	−·00093	−·00132
20 19 ...	−·00094	−·00138	−·00161	−·00173	−·00179	−·00168	−·00175	−·00147	−·00135	−·00183	−·00159	−·00114	−·00152
21 19 ...	−·00107	−·00163	−·00179	−·00179	−·00150	−·00155	−·00170	−·00140	−·00110	−·00185	−·00167	−·00127	−·00153
22 19 ...	−·00114	−·00184	−·00199	−·00211	−·00152	−·00141	−·00165	−·00124	−·00108	−·00191	−·00149	−·00110	−·00154
23 19 ...	−·00096	−·00173	−·00190	−·00199	−·00128	−·00134	−·00142	−·00104	−·00106	−·00146	−·00139	−·00109	−·00139
0 19 ...	−·00104	−·00122	−·00157	−·00166	−·00129	−·00129	−·00146	−·00088	−·00080	−·00123	−·00113	−·00090	−·00121
1 19 ...	−·00103	−·00142	−·00146	−·00154	−·00137	−·00138	−·00143	−·00074	−·00081	−·00095	−·00113	−·00071	−·00116
2 19 ...	−·00094	−·00137	−·00110	−·00147	−·00117	−·00119	−·00123	−·00062	−·00072	−·00083	−·00098	−·00079	−·00103
3 19 ...	−·00074	−·00122	−·00101	−·00138	−·00104	−·00117	−·00131	−·00060	−·00040	−·00063	−·00075	−·00066	−·00091
4 19 ...	−·00048	−·00100	−·00096	−·00121	−·00087	−·00108	−·00113	−·00051	−·00027	−·00049	−·00062	−·00052	−·00076
5 19 ...	−·00035	−·00086	−·00092	−·00101	−·00075	−·00089	−·00109	−·00043	−·00006	−·00033	−·00043	−·00037	−·00062
6 19 ...	−·00003	−·00072	−·00095	−·00060	−·00047	−·00059	−·00071	−·00032	−·00024	−·00019	−·00002	−·00013	−·00041
7 19 ...	+·00049	−·00047	−·00044	+·00009	+·00024	+·00031	+·00015	+·00007	−·00053	+·00007	+·00061	+·00033	+·00008
8 19 ...	+·00109	+·00048	+·00089	+·00158	+·00141	+·00144	+·00105	+·00102	−·00001	+·00094	+·00150	+·00077	+·00101
9 19 ...	+·00169	+·00180	+·00250	+·00342	+·00250	+·00287	+·00214	+·00224	+·00116	+·00201	+·00232	+·00125	+·00216
Average progressive increase *per* day ...	−·00007	−·00002	+·00001	−·00001	−·00016	+·00004	+·00005	+·00003	−·00003	−·00004	+·00005	·00000	−·00001

Table 41.—Horizontal Force Magnetograph.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1886 and for the whole year.

1886. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00198	+·00253	+·00381	+·00323	+·00277	+·00273	+·00214	+·00163	+·00185	+·00230	+·00269	+·00171	+·00245
11 19 ...	+·00238	+·00282	+·00439	+·00347	+·00278	+·00281	+·00229	+·00241	+·00233	+·00291	+·00283	+·00175	+·00276
12 19 ...	+·00218	+·00276	+·00393	+·00262	+·00225	+·00245	+·00221	+·00242	+·00229	+·00257	+·00220	+·00134	+·00243
13 19 ...	+·00194	+·00170	+·00299	+·00180	+·00168	+·00167	+·00196	+·00211	+·00184	+·00135	+·00115	+·00078	+·00175
14 19 ...	+·00074	+·00081	+·00142	+·00074	+·00066	+·00069	+·00135	+·00102	+·00089	+·00027	+·00041	+·00038	+·00078
15 19 ...	−·00022	+·00040	−·00001	−·00017	−·00016	−·00005	+·00037	+·00010	+·00006	−·00040	−·00023	−·00008	−·00003
16 19 ...	−·00052	−·00029	−·00091	−·00087	−·00083	−·00080	−·00061	−·00064	−·00053	−·00078	−·00077	−·00061	−·00068
17 19 ...	−·00107	−·00080	−·00134	−·00101	−·00121	−·00111	−·00109	−·00096	−·00062	−·00073	−·00109	−·00064	−·00097
18 19 ...	−·00111	−·00110	−·00166	−·00117	−·00111	−·00102	−·00108	−·00108	−·00062	−·00108	−·00122	−·00076	−·00108
19 19 ...	−·00136	−·00112	−·00151	−·00142	−·00104	−·00110	−·00112	−·00102	−·00074	−·00132	−·00125	−·00074	−·00114
20 19 ...	−·00111	−·00111	−·00171	−·00136	−·00113	−·00119	−·00104	−·00099	−·00083	−·00103	−·00116	−·00099	−·00114
21 19 ...	−·00118	−·00148	−·00161	−·00144	−·00116	−·00122	−·00111	−·00101	−·00084	−·00117	−·00159	−·00109	−·00124
22 19 ...	−·00132	−·00141	−·00174	−·00120	−·00109	−·00106	−·00110	−·00102	−·00116	−·00117	−·00155	−·00093	−·00123
23 19 ...	−·00104	−·00134	−·00151	−·00113	−·00107	−·00088	−·00098	−·00097	−·00097	−·00098	−·00124	−·00049	−·00105
0 19 ...	−·00093	−·00122	−·00137	−·00153	−·00078	−·00086	−·00078	−·00071	−·00087	−·00061	−·00084	−·00064	−·00093
1 19 ...	−·00064	−·00116	−·00122	−·00106	−·00075	−·00073	−·00086	−·00051	−·00073	−·00062	−·00055	−·00044	−·00077
2 19 ...	−·00046	−·00121	−·00111	−·00087	−·00067	−·00083	−·00067	−·00038	−·00039	−·00041	−·00055	−·00033	−·00066
3 19 ...	−·00050	−·00085	−·00091	−·00078	−·00071	−·00079	−·00063	−·00020	−·00031	−·00044	−·00051	−·00030	−·00058
4 19 ...	−·00038	−·00069	−·00109	−·00054	−·00066	−·00070	−·00059	−·00009	−·00033	−·00026	−·00037	−·00062	−·00053
5 19 ...	−·00029	−·00045	−·00068	−·00059	−·00064	−·00064	−·00044	−·00017	−·00020	−·00023	−·00050	−·00002	−·00040
6 19 ...	+·00005	−·00012	−·00093	−·00045	−·00042	−·00035	−·00025	−·00035	−·00043	−·00025	−·00013	+·00016	−·00029
7 19 ...	+·00057	+·00037	−·00044	−·00007	+·00021	+·00028	+·00010	−·00038	−·00071	−·00008	+·00068	+·00029	+·00007
8 19 ...	+·00105	+·00116	+·00081	+·00111	+·00116	+·00092	+·00060	−·00004	−·00011	+·00062	+·00153	+·00100	+·00082
9 19 ...	+·00125	+·00182	+·00241	+·00266	+·00192	+·00177	+·00133	+·00084	+·00112	+·00154	+·00204	+·00128	+·00166
Average progressive increase *per* day	−·00012	+·00003	−·00035	+·00016	−·00002	−·00014	+·00004	+·00001	−·00006	−·00003	−·00012	−·00001	−·00005

TABLE 42.—HORIZONTAL FORCE MAGNETOGRAPH.

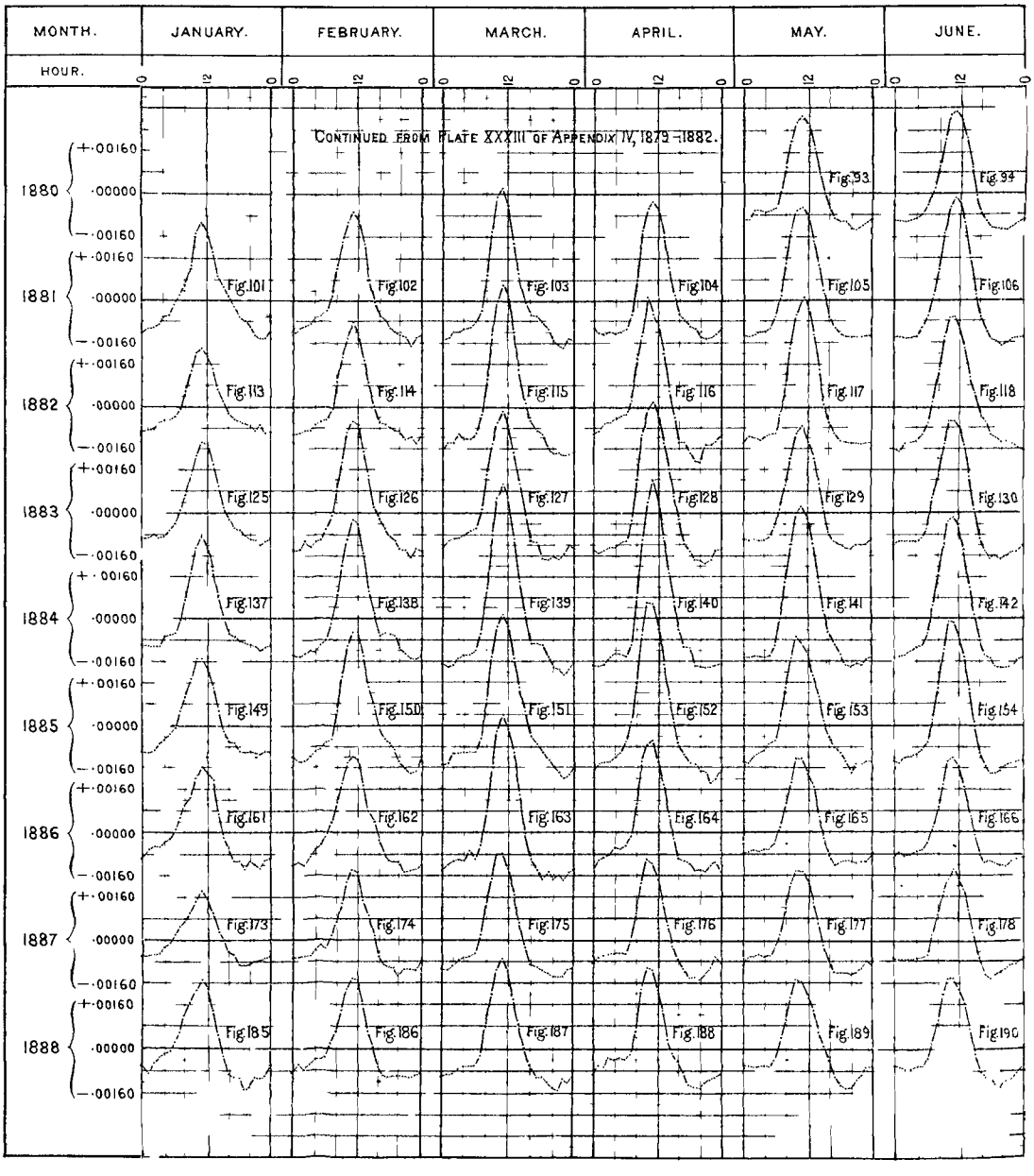
Showing the mean diurnal variation of Horizontal Force for each month of the year 1887 and for the whole year.

1887. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00147	+·00213	+·00321	+·00309	+·00261	+·00229	+·00254	+·00262	+·00230	+·00235	+·00265	+·00193	+·00243
11 19 ...	+·00185	+·00260	+·00322	+·00285	+·00253	+·00265	+·00285	+·00263	+·00249	+·00291	+·00261	+·00216	+·00261
12 19 ...	+·00155	+·00244	+·00270	+·00233	+·00209	+·00231	+·00252	+·00233	+·00187	+·00255	+·00189	+·00183	+·00220
13 19 ...	+·00100	+·00152	+·00166	+·00137	+·00141	+·00191	+·00202	+·00168	+·00122	+·00140	+·00106	+·00111	+·00145
14 19 ...	+·00032	+·00086	+·00068	+·00052	+·00073	+·00115	+·00092	+·00083	+·00052	+·00058	+·00025	+·00029	+·00064
15 19 ...	·00000	+·00014	−·00029	−·00023	−·00010	+·00028	−·00011	−·00005	−·00039	−·00012	−·00050	−·00007	−·00012
16 19 ...	−·00039	−·00060	−·00086	−·00075	−·00078	−·00069	−·00086	−·00074	−·00105	−·00081	−·00072	−·00034	−·00072
17 19 ...	−·00051	−·00089	−·00100	−·00109	−·00117	−·00123	−·00097	−·00102	−·00122	−·00098	−·00094	−·00069	−·00098
18 19 ...	−·00088	−·00099	−·00115	−·00138	−·00118	−·00143	−·00134	−·00099	−·00103	−·00114	−·00099	−·00093	−·00112
19 19 ...	−·00094	−·00102	−·00122	−·00135	−·00120	−·00125	−·00112	−·00108	−·00109	−·00131	−·00124	−·00124	−·00117
20 19 ...	−·00087	−·00132	−·00128	−·00154	−·00123	−·00117	−·00131	−·00121	−·00085	−·00101	−·00118	−·00125	−·00118
21 19 ...	−·00079	−·00113	−·00128	−·00126	−·00118	−·00105	−·00120	−·00136	−·00087	−·00102	−·00098	−·00114	−·00110
22 19 ...	−·00078	−·00113	−·00128	−·00105	−·00103	−·00088	−·00097	−·00123	−·00079	−·00113	−·00120	−·00092	−·00103
23 19 ...	−·00069	−·00114	−·00111	−·00066	−·00078	−·00085	−·00102	−·00097	−·00064	−·00102	−·00073	−·00091	−·00088
0 19 ...	−·00059	−·00073	−·00107	−·00083	−·00090	−·00073	−·00081	−·00080	−·00018	−·00104	−·00072	−·00086	−·00077
1 19 ...	−·00061	−·00073	−·00113	−·00069	−·00074	−·00077	−·00091	−·00063	−·00028	−·00102	−·00087	−·00078	−·00076
2 19 ...	−·00051	−·00066	−·00092	−·00057	−·00064	−·00075	−·00086	−·00054	−·00022	−·00071	−·00063	−·00062	−·00064
3 19 ...	−·00047	−·00064	−·00078	−·00047	−·00053	−·00077	−·00080	−·00052	−·00011	−·00041	−·00065	−·00039	−·00054
4 19 ...	−·00030	−·00038	−·00069	−·00048	−·00069	−·00073	−·00076	−·00057	·00000	−·00029	−·00060	−·00031	−·00048
5 19 ...	−·00010	−·00021	−·00059	−·00046	−·00054	−·00068	−·00069	−·00051	−·00022	−·00023	−·00040	−·00013	−·00040
6 19 ...	+·00016	−·00035	−·00049	−·00047	−·00031	−·00050	−·00048	−·00046	−·00039	−·00028	−·00011	+·00007	−·00030
7 19 ...	+·00044	+·00010	+·00013	−·00001	+·00029	+·00019	+·00029	−·00006	−·00055	+·00003	+·00061	+·00053	+·00017
8 19 ...	+·00070	+·00074	+·00123	+·00096	+·00122	+·00094	+·00115	+·00095	+·00014	+·00088	+·00135	+·00113	+·00095
9 19 ...	+·00095	+·00138	+·00233	+·00213	+·00214	+·00180	+·00192	+·00171	+·00136	+·00184	+·00204	+·00151	+·00176
Average progressive increase *per* day ...	·00000	+·00002	+·00003	−·00014	−·00004	+·00004	+·00004	−·00006	−·00003	+·00001	−·00005	−·00001	−·00002

COLABA OBSERVATORY.

HORIZONTAL FORCE MAGNETOGRAPH. DIURNAL VARIATION.

Plate III.

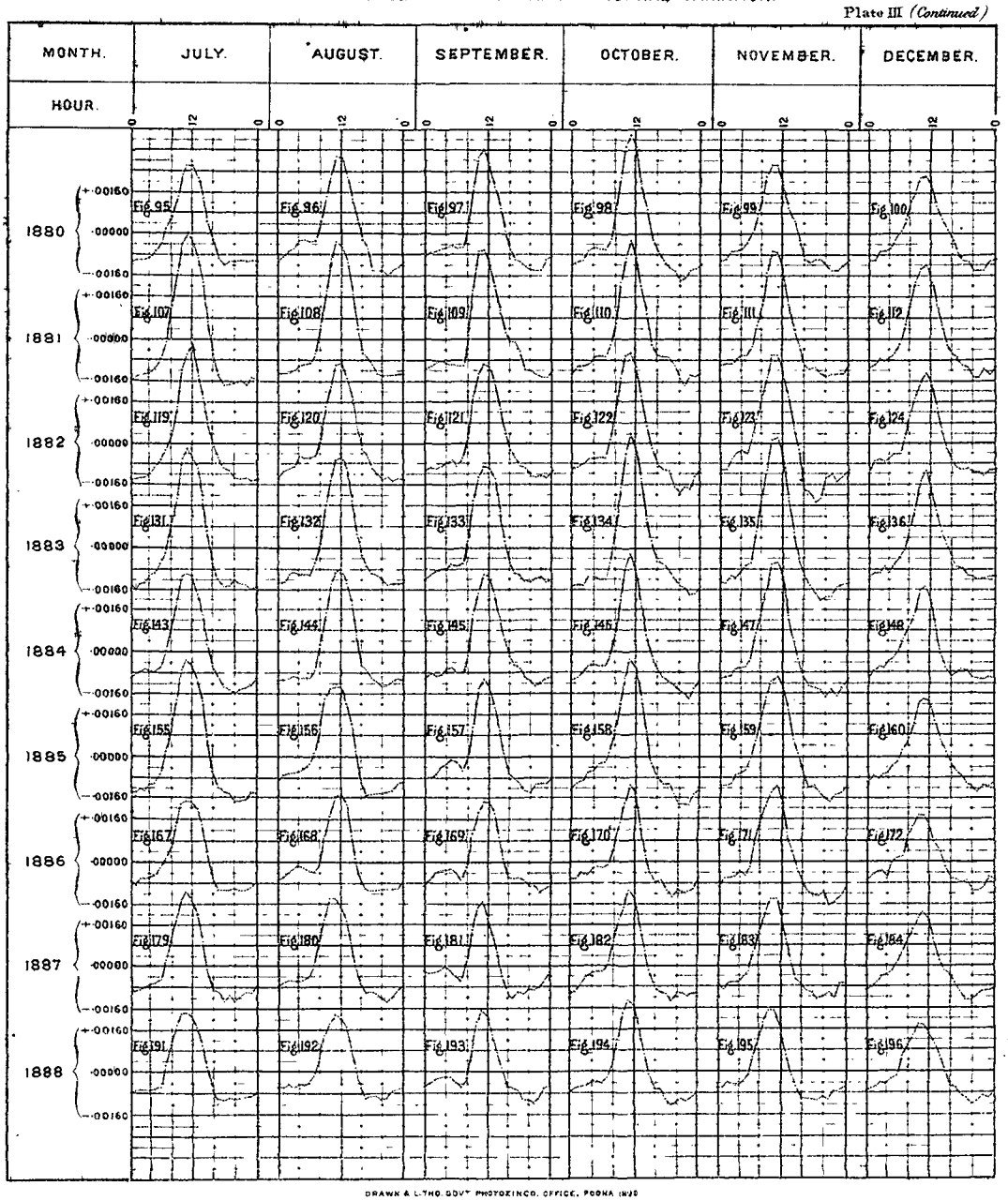


DRAWN & LITHO: GOVT PHOTOZINCO: OFFICE, POONA 1890.

COLABA OBSERVATORY.

HORIZONTAL FORCE MAGNETOGRAPH. DIURNAL VARIATION.

Plate III *(Continued)*



DRAWN & L-THO. GOVT PHOTOZINCO. OFFICE, POONA (INDIA)

TABLE 43.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Horizontal Force for each month of the year 1888 and for the whole year.

1888. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 19 ...	+·00213	+·00220	+·00289	+·00296	+·00252	+·00258	+·00224	+·00186	+·00192	+·00224	+·00236.	+·00183	+·00231
11 19 ...	+·00246	+·00251	+·00326	+·00289	+·00244	+·00261	+·00227	+·00218	+·00236	+·00273	+·00236	+·00176	+·00249
12 19 ...	+·00226	+·00246	+·00283	+·00214	+·00187	+·00224	+·00211	+·00199	+·00217	+·00248	+·00159	+·00149	+·00214
13 19 ...	+·00137	+·00162	+·00183	+·00140	+·00140	+·00165	+·00165	+·00170	+·00147	+·00165	+·00069	+·00107	+·00146
14 19 ...	+·00044	+·00065	+·00083	+·00036	+·00059	+·00072	+·00098	+·00079	+·00077	+·00067	−·00010	+·00058	+·00061
15 19 ...	−·00030	+·00004	+·00003	−·00008	+·00009	−·00015	+·00009	+·00009	+·00008	−·00006	−·00049	+·00002	−·00005
16 19 ...	−·00090	−·00071	−·00055	−·00044	−·00042	−·00079	−·00077	−·00058	−·00047	−·00059	−·00093	−·00045	−·00063
17 19 ...	−·00110	−·00091	−·00098	−·00082	−·00096	−·00100	−·00098	−·00094	−·00062	−·00065	−·00097	−·00056	−·00087
18 19 ...	−·00114	−·00106	−·00098	−·00125	−·00126	−·00108	−·00103	−·00089	−·00076	−·00099	−·00104	−·00082	−·00102
19 19 ...	−·00153	−·00100	−·00118	−·00136	−·00140	−·00125	−·00095	−·00088	−·00100	−·00119	−·00107	−·00094	−·00115
20 19 ..	−·00140	−·00098	−·00137	−·00139	−·00134	−·00135	−·00104	−·00106	−·00104	−·00111	−·00090	−·00116	−·00118
21 19 ...	−·00110	−·00096	−·00150	−·00121	−·00111	−·00116	−·00097	−·00103	−·00113	−·00100	−·00099	−·00112	−·00111
22 19 ...	−·00115	−·00108	−·00109	−·00114	−·00089	−·00108	−·00093	−·00075	−·00100	−·00107	−·00076	−·00084	−·00098
23 19 ...	−·00095	−·00092	−·00120	−·00104	−·00070	−·00084	−·00083	−·00068	−·00062	−·00094	−·00070	−·00091	−·00086
0 19 ...	−·00063	−·00085	−·00098	−·00088	−·00061	−·00060	−·00078	−·00056	−·00052	−·00080	−·00052	−·00077	−·00071
1 19 ...	−·00086	−·00062	−·00087	−·00060	−·00059	−·00068	−·00076	−·00056	−·00040	−·00062	−·00051	−·00060	−·00064
2 19 ...	−·00049	−·00078	−·00085	−·00072	−·00070	−·00076	−·00070	−·00045	−·00034	−·00049	−·00037	−·00047	−·00059
3 19 ...	−·00037	−·00058	−·00077	−·00036	−·00069	−·00076	−·00069	−·00058	−·00026	−·00044	−·00043	−·00037	−·00052
4 19 ...	−·00026	−·00039	−·00062	−·00039	−·00062	−·00066	−·00072	−·00045	−·00017	−·00036	−·00045	−·00040	−·00046
5 19 ...	−·00010	−·00039	−·00063	−·00030	−·00063	−·00060	−·00065	−·00046	−·00017	−·00036	−·00033	−·00026	−·00041
6 19 ...	+·00025	−·00035	−·00062	−·00040	−·00038	−·00035	−·00049	−·00042	−·00037	−·00043	−·00004	−·00006	−·00030
7 19 ...	+·00056	+·00012	−·00024	−·00018	+·00040	+·00023	+·00024	−·00010	−·00053	−·00020	+·00052	+·00063	+·00012
8 19 ...	+·00116	+·00059	+·00078	+·00065	+·00109	+·00108	+·00099	+·00044	−·00019	+·00034	+·00121	+·00097	+·00076
9 19 ...	+·00164	+·00139	+·00198	+·00216	+·00193	+·00199	+·00173	+·00134	+·00085	+·00121	+·00188	+·00138	+·00162
Average progressive increase *per* day ...	−·00004	+·00001	−·00005	−·00003	+·00002	·00000	+·00003	−·00007	−·00005	−·00006	+·00002	−·00002	−·00002

TABLE 44.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1879 and for the whole year.

1879. Bombay Civil Time.	January.	February.	March	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 17 ...	−.00086	−·00057	−·00055	−·00141	−·00157	−·00170	−.00155	−·00195	−.00200	−·00155	−.00109	−.00021	−.00125
11 17 ...	−.00139	−·00080	−·00089	−·00136	−·00153	−·00181	−.00175	−·00185	−.00210	−·00161	−.00091	−.00030	−.00136
12 17 ...	−.00086	−·00041	−·00084	−·00094	−·00106	−·00126	−.00131	−·00121	−.00163	−·00092	−.00026	+.00006	−.00089
13 17 ...	−.00029	+·00001	−·00040	−·00016	−·00032	−·00060	−.00061	−·00034	−.00072	−·00023	+.00010	+.00028	−.00027
14 17 ...	.00000	+·00024	+·00040	+·00031	+·00025	−·00001	+.00003	+·00025	+.00020	+·00032	+.00020	+.00020	+.00020
15 17 ...	+.00019	+·00024	+·00060	+·00047	+·00057	+·00043	+.00052	+·00066	+.00055	+·00042	+.00021	+.00006	+.00041
16 17 ...	+.00034	+·00005	+·00045	+·00042	+·00064	+·00054	+.00064	+·00069	+.00042	+·00019	+.00008	+.00009	+.00038
17 17 ...	+.00014	−·00020	+·00015	+·00016	+·00028	+·00030	+.00053	+·00044	+.00014	+·00003	+.00006	+.00008	+.00018
18 17 ...	+.00024	−·00012	+·00010	+·00005	+·00006	+·00006	+.00021	+·00013	+.00022	+·00026	+.00020	+.00012	+.00013
19 17 ...	+.00024	−·00001	+·00020	·00000	+·00009	+·00003	+.00010	+·00019	+.00024	+·00033	+.00026	+.00009	+.00015
20 17 ...	+.00024	+·00010	+·00030	+·00016	+·00023	+·00018	+.00017	+·00021	+.00038	+·00038	+.00022	+.00007	+.00022
21 17 ...	+.00019	+·00013	+·00025	+·00021	+·00026	+·00025	+.00020	+·00027	+.00039	+·00033	+.00016	+.00003	+.00022
22 17 ...	+.00014	+·00013	+·00020	+·00026	+·00036	+·00036	+.00030	+·00025	+.00042	+·00038	+.00015	−.00003	+.00024
23 17 ...	+.00014	+·00016	+·00020	+·00037	+·00032	+·00033	+.00022	+·00024	+.00043	+·00032	+.00013	−.00003	+.00024
0 17 ...	+.00014	+·00019	+·00020	+·00037	+·00037	+·00035	+.00024	+·00028	+.00045	+·00028	+.00013	−.00003	+.00025
1 17 ...	+.00010	+·00015	+·00020	+·00037	+·00032	+·00031	+.00020	+·00024	+.00044	+·00023	+.00011	−.00008	+.00022
2 17 ...	+.00014	+·00017	+·00010	+·00026	+·00035	+·00033	+.00025	+·00030	+.00042	+·00022	+.00008	−.00012	+.00021
3 17 ...	+.00014	+·00016	+·00005	+·00021	+·00025	+·00027	+.00021	+·00028	+.00043	+·00012	+.00005	−.00015	+.00017
4 17 ...	+.00014	+·00017	·00000	+·00016	+·00030	+·00031	+.00027	+·00031	+.00051	+·00016	+.00008	−.00013	+.00019
5 17 ...	+.00014	+·00012	·00000	+·00026	+·00047	+·00056	+.00047	+·00048	+.00063	+·00020	+.00012	−.00008	+.00028
6 17 ...	+.00019	+·00003	·00000	+·00058	+·00079	+·00099	+.00088	+·00100	+.00109	+·00052	+.00010	−.00012	+.00050
7 17 ...	+.00029	+·00018	+·00020	+·00037	+·00038	+·00082	+.00067	+·00072	+.00083	+·00056	+.00016	−.00017	+.00042
8 17 ...	+.00048	+·00019	·00000	−·00031	−·00044	−·00002	+.00009	−·00023	−.00037	−·00001	+.00004	+.00015	−.00004
9 17 ...	+.00019	−·00031	−·00030	−·00094	−·00135	−·00096	−.00093	−·00132	−.00137	−·00089	−.00042	+.00029	−.00069
Average progressive increase *per* day ...	+·00002	+·00004	−·00014	−·00012	−·00008	+·00007	·00000	+·00009	+·00002	+·00008	+·00011	+·00023	+·00003

TABLE 45.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1880 and for the whole year.

1880. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 17 ...	+·00025	−·00024	−·00027	−·00104	−·00133	−·00113	−·00149	−·00224	−·00250	−·00160	−·00074	−·00029	−·00105
11 17 ...	−·00030	−·00066	−·00078	−·00138	−·00128	−·00148	−·00144	−·00208	−·00244	−·00166	−·00073	−·00040	−·00122
12 17 ...	−·00031	−·00031	−·00076	−·00108	−·00101	−·00122	−·00118	−·00159	−·00162	−·00101	−·00022	−·00007	−·00086
13 17 ...	+·00004	+·00015	−·00019	−·00041	−·00029	−·00061	−·00058	−·00087	−·00047	−·00012	−·00002	+·00002	−·00028
14 17 ...	−·00010	+·00039	+·00029	+·00018	+·00021	−·00001	−·00012	−·00015	+·00037	+·00027	−·00012	−·00004	+·00010
15 17 ...	−·00016	+·00049	+·00045	+·00047	+·00051	+·00047	+·00029	+·00028	+·00080	+·00033	−·00008	−·00005	+·00032
16 17 ...	−·00001	+·00044	+·00017	+·00049	+·00050	+·00050	+·00038	+·00043	+·00061	−·00001	−·00014	+·00002	+·00028
17 17 ...	−·00010	+·00011	−·00015	+·00023	+·00024	+·00031	+·00029	+·00020	+·00002	−·00033	−·00022	−·00008	+·00004
18 17 ...	−·00006	+·00008	−·00016	−·00006	+·00001	+·00004	+·00004	+·00011	+·00001	−·00011	−·00001	−·00004	−·00001
19 17 ..	−·00004	+·00012	−·00003	−·00004	−·00004	−·00003	−·00010	+·00008	+·00016	+·00010	+·00008	+·00004	+·00002
20 17 ...	·00000	+·00008	+·00002	+·00010	+·00008	+·00005	+·00003	+·00020	+·00026	+·00009	+·00013	+·00002	+·00009
21 17 ...	−·00005	+·00006	+·00011	+·00022	+·00022	+·00012	+·00017	+·00039	+·00029	+·00019	+·00019	+·00008	+·00017
22 17 ...	−·00005	+·00009	+·00012	+·00022	+·00028	+·00022	+·00030	+·00048	+·00038	+·00037	+·00022	+·00014	+·00023
23 17 ...	−·00011	+·00010	+·00016	+·00028	+·00027	+·00028	+·00033	+·00054	+·00047	+·00044	+·00027	+·00015	+·00026
0 17 ...	−·00001	+·00011	+·00015	+·00029	+·00028	+·00026	+·00039	+·00058	+·00054	+·00046	+·00025	+·00012	+·00028
1 17 ...	+·00001	+·00008	+·00012	+·00022	+·00025	+·00026	+·00038	+·00061	+·00061	+·00041	+·00022	+·00010	+·00027
2 17 ...	·00000	+·00004	+·00008	+·00020	+·00024	+·00021	+·00038	+·00054	+·00055	+·00039	+·00021	+·00004	+·00024
3 17 ...	+·00006	−·00002	+·00006	+·00018	+·00021	+·00021	+·00038	+·00056	+·00050	+·00033	+·00013	·00000	+·00022
4 17 ...	+·00008	−·00004	+·00005	+·00015	+·00023	+·00026	+·00035	+·00058	+·00051	+·00035	+·00012	−·00002	+·00022
5 17 ...	+·00010	−·00011	+·00001	+·00018	+·00045	+·00042	+·00063	+·00075	+·00063	+·00044	+·00012	−·00004	+·00030
6 17 ...	+·00005	−·00020	+·00008	+·00053	+·00075	+·00079	+·00096	+·00132	+·00122	+·00072	+·00002	−·00008	+·00051
7 17 ...	−·00003	−·00011	+·00041	+·00061	+·00056	+·00072	+·00066	+·00087	+·00101	+·00076	+·00030	−·00004	+·00048
8 17 ...	+·00025	−·00012	+·00028	+·00009	−·00022	+·00012	−·00011	−·00021	−·00028	+·00011	+·00025	+·00020	+·00003
9 17 ...	+·00044	−·00050	−·00008	−·00061	−·00112	−·00069	−·00085	−·00134	−·00156	−·00083	−·00024	+·00016	−·00060
Average progressive increase *per* day ...	+·00007	−·00076	−·00020	−·00016	−·00008	−·00004	−·00006	−·00006	−·00005	·00000	−·00001	+·00005	−·00011

TABLE 46.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1881 and for the whole year.

1881.	MONTH.												Year.
Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h. m.													
10 17 ...	−·00093	−·00048	−·00096	−·00160	−·00197	−·00176	−·00160	−·00215	−·00266	−·00181	−·00068	+·00003	−·00138
11 17 ...	−·00139	−·00096	−·00128	−·00159	−·00181	−·00199	−·00147	−·00198	−·00271	−·00178	−·00061	−·00018	−·00148
12 17 ...	−·00096	−·00090	−·00089	−·00106	−·00115	−·00159	−·00108	−·00144	−·00193	−·00092	−·00013	−·00002	−·00101
13 17 ...	−·00033	−·00050	−·00016	−·00030	−·00014	−·00081	−·00048	−·00076	−·00077	+·00002	+·00019	+·00007	−·00033
14 17 ...	−·00005	−·00013	+·00026	+·00033	+·00055	−·00003	+·00011	−·00006	+·00025	+·00049	+·00016	−·00017	+·00014
15 17 ...	+·00020	−·00001	+·00033	+·00060	+·00090	+·00054	+·00064	+·00039	+·00071	+·00043	+·00009	−·00029	+·00038
16 17 ...	+·00019	−·00004	+·00002	+·00047	+·00080	+·00075	+·00071	+·00065	+·00058	−·00004	−·00002	−·00019	+·00032
17 17 ...	−·00006	−·00019	−·00034	+·00006	+·00030	+·00043	+·00046	+·00033	+·00019	−·00043	−·00031	−·00024	+·00002
18 17 ...	+·00004	−·00009	−·00021	−·00011	−·00011	−·00001	−·00012	−·00007	+·00019	−·00005	−·00006	−·00011	−·00006
19 17 ...	+·00018	+·00013	+·00010	−·00004	−·00007	−·00016	−·00037	−·00010	+·00023	+·00011	−·00003	−·00004	·00000
20 17 ...	+·00017	+·00015	+·00011	+·00010	+·00008	+·00010	−·00010	+·00003	+·00028	+·00017	−·00003	−·00004	+·00008
21 17 ...	+·00018	+·00015	+·00008	+·00021	+·00019	+·00024	+·00002	+·00021	+·00039	+·00018	+·00006	−·00001	+·00016
22 17 ...	+·00023	+·00025	+·00015	+·00024	+·00027	+·00029	+·00019	+·00036	+·00052	+·00038	+·00019	+·00007	+·00026
23 17 ...	+·00030	+·00031	+·00026	+·00032	+·00028	+·00031	+·00023	+·00046	+·00059	+·00046	+·00018	+·00016	+·00032
0 17 ...	+·00030	+·00033	+·00030	+·00038	+·00027	+·00039	+·00034	+·00051	+·00065	+·00048	+·00017	+·00015	+·00036
1 17 ...	+·00033	+·00030	+·00026	+·00040	+·00028	+·00036	+·00037	+·00052	+·00063	+·00044	+·00014	+·00008	+·00034
2 17 ...	+·00022	+·00026	+·00024	+·00035	+·00028	+·00031	+·00034	+·00051	+·00062	+·00039	+·00010	+·00006	+·00031
3 17 ...	+·00019	+·00020	+·00021	+·00029	+·00026	+·00032	+·00035	+·00048	+·00053	+·00034	+·00008	−·00001	+·00027
4 17 ...	+·00014	+·00015	+·00020	+·00029	+·00039	+·00041	+·00040	+·00053	+·00055	+·00036	+·00008	−·00001	+·00029
5 17 ...	+·00019	+·00013	+·00019	+·00038	+·00068	+·00078	+·00075	+·00081	+·00067	+·00047	+·00005	−·00002	+·00042
6 17 ...	+·00013	+·00012	+·00042	+·00088	+·00110	+·00127	+·00119	+·00150	+·00138	+·00087	−·00004	−·00008	+·00073
7 17 ...	+·00031	+·00023	+·00069	+·00067	+·00059	+·00097	+·00066	+·00105	+·00113	+·00080	+·00027	+·00002	+·00062
8 17 ...	+·00046	+·00045	+·00037	−·00017	−·00043	+·00001	−·00030	−·00026	−·00041	−·00014	+·00031	+·00036	+·00002
9 17 ...	−·00004	+·00015	−·00033	−·00115	−·00160	−·00105	−·00130	−·00150	−·00165	−·00128	−·00015	+·00038	−·00079
Average progressive increase *per* day ...	+·00004	·00000	−·00022	−·00004	−·00015	−·00007	−·00005	−·00005	−·00007	−·00004	−·00005	−·00009	−·00007

Table 47.—Vertical Force Magnetograph.

Showing the mean diurnal variation of Vertical Force for each month of the year 1882 and for the whole year.

1882. Bombay Civil Time.			MONTH.											Year.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.														
10	17	...	−·00064	−·00062	−·00085	−·00173	−·00176	−·00159	−·00172	−·00205	−·00200	−·00152	−·00064	−·00081	−·00128
11	17	...	−·00084	−·00127	−·00132	−·00191	−·00203	−·00187	−·00185	−·00191	−·00202	−·00146	−·00070	−·00056	−·00148
12	17	...	−·00037	−·00099	−·00131	−·00151	−·00158	−·00134	−·00150	−·00147	−·00153	−·00075	−·00018	−·00041	−·00108
13	17	...	−·00012	−·00045	−·00046	−·00042	−·00077	−·00065	−·00074	−·00081	−·00064	+·00004	+·00001	−·00022	−·00044
14	17	...	−·00013	−·00018	+·00029	+·00021	−·00012	−·00005	−·00010	−·00034	+·00010	+·00043	−·00006	−·00018	−·00001
15	17	...	−·00007	+·00004	+·00050	+·00046	+·00040	+·00023	+·00013	+·00011	+·00039	+·00038	−·00010	−·00015	+·00019
16	17	...	−·00008	−·00004	+·00017	+·00028	+·00049	+·00026	+·00018	+·00042	+·00031	·00000	−·00022	−·00012	+·00014
17	17	...	−·00024	−·00029	−·00036	−·00014	+·00031	+·00021	+·00004	+·00041	−·00002	−·00040	−·00033	−·00003	−·00007
18	17	...	−·00009	−·00021	−·00034	−·00017	−·00002	+·00006	+·00016	+·00028	+·00002	−·00002	−·00006	−·00007	−·00004
19	17	...	−·00001	+·00008	−·00005	+·00003	−·00009	−·00017	−·00008	+·00014	+·00018	+·00011	−·00004	·00000	+·00001
20	17	...	−·00002	+·00004	·00000	+·00013	+·00008	+·00010	+·00013	+·00022	+·00030	+·00011	−·00003	−·00002	+·00009
21	17	...	+·00002	+·00004	+·00007	+·00026	+·00029	+·00024	+·00025	+·00033	+·00036	+·00020	+·00015	+·00006	+·00019
22	17	...	+·00011	+·00013	+·00019	+·00034	+·00040	+·00041	+·00041	+·00046	+·00046	+·00037	+·00030	+·00015	+·00031
23	17	...	+·00015	+·00025	+·00031	+·00043	+·00047	+·00047	+·00051	+·00051	+·00054	+·00041	+·00033	+·00021	+·00038
0	17	...	+·00018	+·00028	+·00031	+·00048	+·00050	+·00053	+·00053	+·00053	+·00055	+·00038	+·00021	+·00021	+·00039
1	17	...	+·00020	+·00029	+·00027	+·00050	+·00046	+·00043	+·00052	+·00050	+·00051	+·00037	+·00025	+·00018	+·00037
2	17	...	+·00020	+·00031	+·00028	+·00042	+·00049	+·00044	+·00048	+·00044	+·00049	+·00033	+·00021	+·00018	+·00036
3	17	...	+·00015	+·00026	+·00022	+·00039	+·00046	+·00039	+·00049	+·00043	+·00041	+·00029	+·00012	+·00015	+·00031
4	17	...	+·00014	+·00028	+·00025	+·00037	+·00041	+·00038	+·00053	+·00045	+·00042	+·00032	+·00010	+·00011	+·00031
5	17	...	+·00008	+·00029	+·00027	+·00049	+·00069	+·00068	+·00070	+·00062	+·00051	+·00039	+·00010	+·00011	+·00041
6	17	...	+·00017	+·00046	+·00040	+·00096	+·00124	+·00108	+·00106	+·00113	+·00100	+·00063	−·00002	+·00006	+·00068
7	17	...	+·00027	+·00057	+·00075	+·00082	+·00084	+·00076	+·00070	+·00088	+·00082	+·00044	+·00029	+·00011	+·00060
8	17	...	+·00064	+·00060	+·00050	+·00015	−·00007	−·00008	+·00002	−·00009	−·00006	−·00021	+·00034	+·00035	+·00017
9	17	...	+·00027	+·00014	−·00009	−·00085	−·00105	−·00090	−·00082	−·00116	−·00108	−·00085	−·00002	+·00033	−·00051
Average progressive increase *per* day		...	−·00008	−·00009	+·00004	+·00006	−·00009	−·00003	·00000	−·00015	−·00017	−·00001	−·00008	−·00023	−·00007

TABLE 48.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1883 and for the whole year.

1883. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 17 ...	−·00097	−·00015	−·00059	−·00199	−·00201	−·00166	−·00166	−·00160	−·00244	−·00151	−·00098	−·00105	−·00138
11 17 ...	−·00143	−·00053	−·00105	−·00209	−·00197	−·00172	−·00169	−·00162	−·00227	−·00172	−·00078	−·00096	−·00149
12 17 ...	−·00106	−·00044	−·00085	−·00145	−·00152	−·00141	−·00138	−·00135	−·00156	−·00105	−·00012	−·00047	−·00105
13 17 ...	−·00045	−·00026	−·00029	−·00047	−·00068	−·00072	−·00090	−·00089	−·00060	−·00027	+·00033	−·00018	−·00045
14 17 ...	−·00015	−·00030	+·00029	+·00024	−·00004	−·00009	−·00027	−·00020	+·00021	+·00017	+·00010	−·00004	−·00001
15 17 ...	+·00005	−·00024	+·00030	+·00049	+·00034	+·00047	+·00026	+·00036	+·00058	+·00025	−·00017	+·00001	+·00022
16 17 ...	+·00004	−·00029	·00000	+·00029	+·00031	+·00061	+·00050	+·00059	+·00049	−·00003	−·00029	−·00019	+·00017
17 17 ...	−·00020	−·00029	−·00037	−·00004	+·00009	+·00043	+·00048	+·00022	+·00006	−·00038	−·00049	−·00043	−·00008
18 17 ...	+·00004	−·00019	−·00025	−·00029	−·00010	+·00010	+·00019	−·00001	−·00006	−·00002	−·00005	−·00003	−·00006
19 17 ...	+·00013	−·00001	−·00008	−·00004	−·00005	−·00006	−·00008	−·00007	+·00016	+·00016	+·00005	+·00005	+·00001
20 17 ...	+·00012	+·00003	+·00002	+·00015	+·00012	+·00009	+·00010	+·00011	+·00028	+·00015	+·00004	−·00005	+·00010
21 17 ...	+·00016	+·00008	+·00007	+·00028	+·00031	+·00022	+·00026	+·00024	+·00037	+·00020	+·00018	+·00005	+·00020
22 17 ...	+·00026	+·00013	+·00013	+·00036	+·00038	+·00032	+·00041	+·00033	+·00050	+·00044	+·00035	+·00018	+·00032
23 17 ...	+·00031	+·00019	+·00023	+·00046	+·00045	+·00036	+·00046	+·00036	+·00061	+·00052	+·00044	+·00025	+·00039
0 17 ...	+·00033	+·00022	+·00024	+·00050	+·00049	+·00036	+·00046	+·00040	+·00061	+·00049	+·00036	+·00031	+·00040
1 17 ...	+·00031	+·00023	+·00024	+·00054	+·00051	+·00033	+·00042	+·00038	+·00058	+·00044	+·00032	+·00031	+·00038
2 17 ...	+·00030	+·00023	+·00022	+·00051	+·00054	+·00031	+·00035	+·00035	+·00055	+·00038	+·00025	+·00031	+·00036
3 17 ...	+·00026	+·00016	+·00016	+·00048	+·00051	+·00031	+·00032	+·00032	+·00052	+·00029	+·00014	+·00027	+·00031
4 17 ...	+·00024	+·00008	+·00016	+·00051	+·00058	+·00037	+·00039	+·00035	+·00054	+·00029	+·00014	+·00025	+·00032
5 17 ...	+·00027	+·00007	+·00017	+·00062	+·00082	+·00067	+·00063	+·00054	+·00067	+·00033	+·00013	+·00024	+·00043
6 17 ...	+·00031	+·00007	+·00024	+·00103	+·00121	+·00106	+·00103	+·00108	+·00128	+·00060	+·00007	+·00031	+·00069
7 17 ...	+·00038	+·00025	+·00048	+·00079	+·00088	+·00073	+·00075	+·00082	+·00092	+·00070	+·00020	+·00037	+·00061
8 17 ...	+·00053	+·00054	+·00043	+·00004	−·00004	−·00005	−·00005	+·00012	−·00039	+·00020	+·00011	+·00050	+·00016
9 17 ...	+·00025	+·00043	+·00008	−·00089	−·00118	−·00098	−·00095	−·00085	−·00160	−·00066	−·00036	−·00003	−·00056
Average progressive increase *per* day ...	+·00005	+·00008	−·00002	−·00009	−·00007	+·00012	+·00005	−·00025	−·00002	+·00001	−·00020	−·00028	−·00005

Table 49.—Vertical Force Magnetograph.

Showing the mean diurnal variation of Vertical Force for each month of the year 1884 and for the whole year.

1884. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 17 ...	−·00065	−·00021	−·00136	−·00221	−·00194	−·00185	−·00172	−·00259	−·00239	−·00146	−·00037	−·00032	−·00142
11 17 ...	−·00117	−·00113	−·00163	−·00235	−·00177	−·00179	−·00178	−·00232	−·00270	−·00156	−·00080	−·00062	−·00163
12 17 ...	−·00106	−·00097	−·00128	−·00172	−·00115	−·00125	−·00128	−·00146	−·00208	−·00101	−·00060	−·00047	−·00119
13 17 ...	−·00068	−·00082	−·00041	−·00058	−·00030	−·00046	−·00060	−·00068	−·00094	−·00041	−·00043	−·00051	−·00057
14 17 ...	−·00048	−·00085	+·00042	+·00031	+·00035	+·00022	+·00009	+·00018	+·00024	+·00007	−·00057	−·00064	−·00005
15 17 ...	−·00022	−·00050	+·00042	+·00072	+·00056	+·00059	+·00042	+·00071	+·00073	+·00011	−·00044	−·00049	+·00022
16 17 ...	−·00014	−·00026	+·00007	+·00061	+·00047	+·00062	+·00037	+·00075	+·00065	−·00009	−·00025	−·00025	+·00021
17 17 ...	−·00027	−·00025	−·00039	+·00016	+·00009	+·00032	+·00024	+·00038	+·00019	−·00044	−·00028	−·00021	−·00004
18 17 ...	−·00005	−·00010	−·00031	−·00006	−·00013	−·00011	−·00002	+·00001	·00000	−·00011	−·00007	−·00003	−·00008
19 17 ...	+·00016	+·00030	+·00015	+·00012	−·00013	−·00022	−·00020	+·00006	+·00019	+·00007	+·00006	+·00009	+·00005
20 17 ...	+·00014	+·00033	+·00024	+·00024	+·00004	+·00001	−·00004	+·00015	+·00027	+·00011	+·00015	+·00015	+·00015
21 17 ...	+·00015	+·00018	+·00017	+·00034	+·00017	+·00013	+·00011	+·00026	+·00033	+·00021	+·00015	+·00018	+·00020
22 17 ...	+·00021	+·00026	+·00030	+·00047	+·00025	+·00024	+·00026	+·00035	+·00046	+·00038	+·00026	+·00022	+·00030
23 17 ...	+·00025	+·00038	+·00043	+·00054	+·00033	+·00026	+·00033	+·00042	+·00050	+·00042	+·00029	+·00025	+·00037
0 17 ...	+·00030	+·00044	+·00044	+·00060	+·00041	+·00030	+·00040	+·00046	+·00057	+·00044	+·00032	+·00025	+·00041
1 17 ...	+·00031	+·00041	+·00043	+·00056	+·00041	+·00032	+·00044	+·00049	+·00054	+·00044	+·00032	+·00021	+·00041
2 17 ...	+·00031	+·00038	+·00036	+·00046	+·00039	+·00035	+·00047	+·00053	+·00057	+·00043	+·00027	+·00017	+·00039
3 17 ...	+·00023	+·00029	+·00026	+·00040	+·00039	+·00036	+·00048	+·00056	+·00052	+·00039	+·00021	+·00016	+·00035
4 17 ...	+·00022	+·00022	+·00027	+·00044	+·00043	+·00048	+·00057	+·00065	+·00054	+·00038	+·00017	+·00011	+·00037
5 17 ...	+·00024	+·00015	+·00032	+·00060	+·00063	+·00080	+·00081	+·00090	+·00069	+·00040	+·00012	+·00009	+·00048
6 17 ...	+·00035	+·00023	+·00065	+·00118	+·00113	+·00120	+·00109	+·00146	+·00126	+·00065	+·00001	+·00009	+·00077
7 17 ...	+·00055	+·00034	+·00079	+·00080	+·00075	+·00077	+·00072	+·00096	+·00109	+·00074	+·00038	+·00027	+·00068
8 17 ...	+·00085	+·00067	+·00027	−·00025	−·00019	−·00019	−·00017	−·00049	+·00003	+·00029	+·00070	+·00071	+·00019
9 17 ...	+·00044	+·00048	−·00058	−·00135	−·00121	−·00110	−·00104	−·00173	−·00122	−·00050	+·00039	+·00059	−·00057
Average progressive increase *per* day ...	·00000	−·00027	−·00009	−·00009	−·00011	·00000	+·00010	+·00006	+·00004	+·00005	·00000	−·00002	−·00003

TABLE 50.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1885 and for the whole year.

1885. Bombay Civil Time.			MONTH.											Year.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.														
10	17	...	−·00060	−·00112	−·00085	−·00157	−·00179	−·00151	−·00151	−·00208	−·00230	−·00095	−·00064	−·00058	−·00129
11	17	...	−·00116	−·00131	−·00121	−·00181	−·00171	−·00152	−·00151	−·00173	−·00221	−·00124	−·00076	−·00067	−·00140
12	17	...	−·00077	−·00065	−·00129	−·00133	−·00124	−·00119	−·00121	−·00110	−·00142	−·00086	−·00026	−·00036	−·00097
13	17	...	−·00027	+·00012	−·00067	−·00046	−·00035	−·00047	−·00068	−·00030	−·00061	−·00024	+·00013	−·00030	−·00034
14	17	...	−·00006	+·00036	+·00036	+·00027	+·00027	+·00009	+·00001	+·00037	+·00031	+·00010	+·00015	−·00038	+·00015
15	17	..	+·00011	+·00033	+·00084	+·00060	+·00061	+·00043	+·00053	+·00074	+·00063	+·00011	+·00002	−·00026	+·00039
16	17	...	+·00018	+·00014	+·00055	+·00047	+·00062	+·00058	+·00071	+·00078	+·00053	−·00010	−·00001	−·00009	+·00036
17	17	...	−·00003	−·00020	−·00002	+·00009	+·00039	+·00034	+·00037	+·00030	+·00002	−·00027	−·00011	−·00007	+·00007
18	17	...	+·00005	−·00001	−·00010	+·00004	+·00005	+·00003	−·00014	−·00022	+·00010	−·00009	+·00007	+·00011	−·00001
19	17	...	+·00018	+·00022	+·00017	+·00018	+·00005	−·00014	−·00028	−·00009	+·00027	+·00006	+·00018	+·00020	+·00008
20	17	...	+·00019	+·00025	+·00024	+·00034	+·00015	−·00001	−·00007	+·00001	+·00036	+·00011	+·00019	+·00021	+·00016
21	17	...	+·00020	+·00022	+·00022	+·00039	+·00023	+·00009	·00000	+·00012	+·00038	+·00017	+·00024	+·00024	+·00021
22	17	...	+·00025	+·00028	+·00022	+·00044	+·00031	+·00020	+·00015	+·00022	+·00048	+·00033	+·00027	+·00024	+·00028
23	17	..	+·00020	+·00030	+·00028	+·00041	+·00032	+·00025	+·00019	+·00021	+·00052	+·00035	+·00025	+·00024	+·00029
0	17	...	+·00017	+·00030	+·00028	+·00040	+·00037	+·00029	+·00027	+·00030	+·00047	+·00039	+·00025	+·00021	+·00031
1	17	...	+·00010	+·00034	+·00025	+·00039	+·00036	+·00032	+·00031	+·00036	+·00053	+·00036	+·00017	+·00022	+·00031
2	17	...	+·00007	+·00029	+·00024	+·00038	+·00031	+·00031	+·00035	+·00041	+·00048	+·00035	+·00012	+·00017	+·00029
3	17	...	−·00001	+·00022	+·00017	+·00028	+·00030	+·00028	+·00037	+·00043	+·00044	+·00028	+·00005	+·00011	+·00024
4	17	...	·00000	+·00016	+·00014	+·00026	+·00036	+·00039	+·00040	+·00049	+·00051	+·00028	−·00002	+·00009	+·00025
5	17	...	−·00001	+·00014	+·00013	+·00027	+·00060	+·00063	+·00070	+·00078	+·00060	+·00030	−·00005	+·00007	+·00035
6	17	...	·00000	+·00013	+·00017	+·00069	+·00100	+·00102	+·00104	+·00124	+·00111	+·00043	−·00021	−·00007	+·00055
7	17	...	+·00010	+·00011	+·00034	+·00047	+·00050	+·00068	+·00069	+·00072	+·00077	+·00053	−·00002	+·00004	+·00041
8	17	...	+·00057	−·00005	+·00002	−·00019	−·00038	−·00008	+·00004	−·00043	−·00035	+·00014	+·00011	+·00038	−·00002
9	17	...	+·00053	−·00055	−·00044	−·00097	−·00133	−·00104	−·00077	−·00152	−·00157	−·00051	−·00012	+·00029	−·00067
Average progressive increase *per* day		...	+·00001	−·00002	−·00019	−·00008	−·00022	−·00011	+·00009	+·00007	−·00007	+·00001	−·00004	−·00008	−·00005

TABLE 51.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1886 and for the whole year.

1886. Bombay Civil Time.			MONTH. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h.	m.														
10	17	...	−·00012	+·00015	−·00072	−·00155	−·00175	−·00118	−·00135	−·00175	−·00193	−·00133	−·00043	+·00018	−·00098
11	17	...	−·00076	−·00010	−·00091	−·00161	−·00154	−·00134	−·00129	−·00162	−·00206	−·00157	−·00023	+·00008	−·00108
12	17	..	−·00072	−·00016	−·00065	−·00116	−·00106	−·00114	−·00107	−·00122	−·00163	−·00108	+·00021	+·00006	−·00080
13	17	...	−·00057	−·00038	−·00026	−·00057	−·00036	−·00055	−·00064	−·00054	−·00065	−·00027	+·00040	+·00011	−·00036
14	17	...	−·00049	−·00050	+·00020	−·00004	+·00025	−·00008	−·00021	+·00005	+·00023	+·00026	+·00024	+·00006	·00000
15	17	...	−·00045	−·00053	+·00037	+·00037	+·00050	+·00023	+·00004	+·00045	+·00058	+·00045	+·00005	·00000	+·00017
16	17	..	−·00019	−·00028	+·00009	+·00040	+·00049	+·00024	+·00016	+·00057	+·00051	+·00024	+·00001	+·00009	+·00019
17	17	...	−·00012	−·00014	−·00017	+·00011	+·00026	+·00023	+·00019	+·00036	+·00016	−·00005	−·00006	−·00001	+·00006
18	17	...	·00000	−·00006	−·00015	+·00001	−·00001	+·00008	+·00005	−·00002	+·00008	+·00003	+·00003	−·00004	·00000
19	17	..	+·00017	+·00005	+·00002	+·00014	·00000	−·00009	−·00007	+·00003	+·00020	+·00014	+·00001	−·00002	+·00005
20	17	...	+·00015	+·00008	+·00007	+·00021	+·00014	+·00002	+·00003	+·00009	+·00028	+·00019	+·00003	−·00006	+·00010
21	17	...	+·00017	+·00010	+·00012	+·00032	+·00021	+·00011	+·00017	+·00022	+·00038	+·00025	+·00007	−·00006	+·00017
22	17	....	+·00022	+·00012	+·00020	+·00039	+·00031	+·00020	+·00027	+·00028	+·00041	+·00030	+·00007	−·00003	+·00023
23	17	...	+·00021	+·00015	+·00026	+·00046	+·00036	+·00025	+·00037	+·00034	+·00043	+·00034	+·00010	−·00001	+·00027
0	17	...	+·00021	+·00017	+·00025	+·00046	+·00037	+·00032	+·00038	+·00038	+·00050	+·00033	+·00009	−·00001	+·00029
1	17	...	+·00017	+·00014	+·00027	+·00045	+·00041	+·00027	+·00042	+·00041	+·00050	+·00036	+·00007	·00000	+·00029
2	17	..	+·00020	+·00008	+·00020	+·00040	+·00039	+·00024	+·00040	+·00041	+·00049	+·00027	+·00006	−·00006	+·00026
3	17	...	+·00018	−·00001	+·00014	+·00035	+·00034	+·00019	+·00038	+·00037	+·00048	+·00028	−·00003	−·00009	+·00021
4	17	...	+·00015	·00000	+·00013	+·00032	+·00038	+·00022	+·00038	+·00040	+·00046	+·00021	−·00008	−·00011	+·00020
5	17	...	+·00010	−·00005	+·00010	+·00040	+·00065	+·00042	+·00055	+·00058	+·00052	+·00024	−·00007	−·00016	+·00027
6	17	...	+·00008	−·00010	+·00025	+·00081	+·00091	+·00088	+·00098	+·00098	+·00092	+·00044	−·00015	−·00019	+·00048
7	17	...	+·00019	+·00010	+·00034	+·00054	+·00049	+·00078	+·00070	+·00064	+·00069	+·00056	−·00012	−·00018	+·00039
8	17	...	+·00055	+·00048	+·00013	−·00026	−·00039	+·00022	−·00007	−·00024	−·00028	+·00005	−·00009	+·00017	+·00002
9	17	...	+·00062	+·00063	−·00030	−·00093	−·00133	−·00057	−·00078	−·00115	−·00128	−·00066	−·00020	+·00028	−·00047
Average progressive increase *per* day		...	+·00019	·00000	−·00010	−·00005	−·00004	+·00008	−·00009	−·00002	+·00005	+·00012	−·00005	−·00007	·00000

TABLE 52.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1887 and for the whole year.

1887. Bombay Civil Time.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
h. m.													
10 17 ...	−·00069	−·00034	−·00121	−·00179	−·00209	−·00186	−·00183	−·00203	−·00245	−·00144	−·00057	+·00005	−·00135
11 17 ...	−·00118	−·00061	−·00142	−·00184	−·00159	−·00203	−·00206	−·00189	−·00228	−·00152	−·00046	−·00014	−·00142
12 17 ...	−·00094	−·00037	−·00092	−·00127	−·00109	−·00160	−·00160	−·00119	−·00142	−·00078	+·00013	−·00007	−·00093
13 17 ...	−·00051	−·00001	−·00014	−·00033	−·00018	−·00081	−·00080	−·00038	−·00027	−·00007	+·00031	−·00025	−·00029
14 17 ...	−·00030	+·00020	+·00053	+·00033	+·00052	−·00010	−·00007	+·00026	+·00064	+·00037	+·00008	−·00046	+·00017
15 17 ...	−·00009	+·00025	+·00063	+·00067	+·00075	+·00030	+·00047	+·00073	+·00102	+·00056	−·00006	−·00038	+·00040
16 17 ...	+·00016	+·00011	+·00025	+·00061	+·00081	+·00049	+·00061	+·00082	+·00080	+·00031	−·00008	−·00001	+·00041
17 17 ...	+·00014	−·00009	−·00010	+·00031	+·00047	+·00041	+·00036	+·00047	+·00024	−·00007	−·00011	·00000	+·00017
18 17 ...	+·00014	+·00006	·00000	+·00015	+·00003	+·00019	+·00005	−·00016	+·00007	+·00004	+·00001	+·00006	+·00005
19 17 ...	+·00017	+·00014	+·00019	+·00029	+·00019	+·00014	+·00001	−·00001	+·00027	+·00019	+·00005	+·00006	+·00013
20 17 ...	+·00015	+·00017	+·00027	+·00039	+·00026	+·00022	+·00021	+·00014	+·00030	+·00017	+·00006	+·00012	+·00020
21 17 ...	+·00016	+·00017	+·00028	+·00042	+·00032	+·00033	+·00028	+·00020	+·00035	+·00027	+·00015	+·00012	+·00025
22 17 ...	+·00020	+·00020	+·00031	+·00042	+·00037	+·00039	+·00032	+·00024	+·00038	+·00031	+·00022	+·00012	+·00029
23 17 ...	+·00023	+·00021	+·00029	+·00044	+·00037	+·00044	+·00036	+·00031	+·00039	+·00035	+·00022	+·00014	+·00031
0 17 ...	+·00021	+·00014	+·00030	+·00046	+·00039	+·00044	+·00041	+·00030	+·00040	+·00031	+·00021	+·00015	+·00031
1 17 ...	+·00020	+·00012	+·00024	+·00038	+·00038	+·00046	+·00042	+·00031	+·00042	+·00029	+·00014	+·00012	+·00029
2 17 ...	+·00016	+·00006	+·00016	+·00035	+·00038	+·00042	+·00043	+·00036	+·00044	+·00024	+·00008	+·00005	+·00026
3 17 ...	+·00013	+·00002	+·00011	+·00025	+·00035	+·00042	+·00038	+·00037	+·00044	+·00022	+·00003	+·00001	+·00023
4 17 ...	+·00013	−·00004	+·00003	+·00020	+·00037	+·00041	+·00043	+·00044	+·00049	+·00018	−·00001	−·00002	+·00022
5 17 ...	+·00008	−·00008	+·00002	+·00023	+·00057	+·00068	+·00068	+·00071	+·00065	+·00019	−·00004	−·00005	+·00030
6 17 ...	+·00011	−·00011	+·00017	+·00055	+·00081	+·00099	+·00106	+·00112	+·00110	+·00031	−·00021	−·00015	+·00048
7 17 ...	+·00028	−·00014	+·00038	+·00039	+·00026	+·00074	+·00081	+·00069	+·00071	+·00045	−·00004	−·00011	+·00037
8 17 ...	+·00064	+·00005	+·00013	−·00035	−·00079	−·00005	+·00004	−·00038	−·00077	−·00002	+·00002	+·00025	−·00010
9 17 ...	+·00039	−·00010	−·00051	−·00121	−·00184	−·00100	−·00100	−·00144	−·00194	−·00075	−·00014	+·00040	−·00076
Average progressive increase *per* day ...	−·00001	·00000	·00020	−·00008	−·00016	+·00003	+·00006	−·00002	+·00003	−·00010	+·00003	+·00003	−·00003

TABLE 53.—VERTICAL FORCE MAGNETOGRAPH.

Showing the mean diurnal variation of Vertical Force for each month of the year 1888 and for the whole year.

1888. Bombay Civil Time.	MONTH.												Year.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December	
h. m.													
10 17 ...	−·00104	−·00096	−·00069	−·00202	−·00177	−·00155	−·00174	−·00208	−·00244	−·00143	−·00059	−·00020	−·00138
11 17 ...	−·00113	−·00104	−·00116	−·00190	−·00149	−·00175	−·00198	−·00196	−·00243	−·00154	−·00047	−·00040	−·00144
12 17 ...	−·00053	−·00046	−·00130	−·00135	−·00102	−·00155	−·00152	−·00136	−·00151	−·00088	+·00005	−·00028	−·00098
13 17 ...	−·00019	+·00012	−·00075	−·00051	−·00019	−·00073	−·00076	−·00052	−·00042	−·00004	+·00042	−·00001	−·00030
14 17 ...	−·00001	+·00039	+·00022	+·00042	+·00042	−·00022	−·00019	+·00024	+·00039	+·00046	+·00044	+·00012	+·00022
15 17 ...	+·00026	+·00046	+·00059	+·00081	+·00053	+·00017	+·00033	+·00067	+·00076	+·00061	+·00027	+·00004	+·00046
16 17 ...	+·00029	+·00025	+·00036	+·00070	+·00055	+·00034	+·00051	+·00079	+·00066	+·00035	+·00002	−·00001	+·00040
17 17 ...	−·00005	−·00010	·00000	+·00036	+·00032	+·00027	+·00042	+·00051	+·00021	−·00001	−·00005	−·00003	+·00015
18 17 ...	+·00008	−·00004	−·00001	+·00018	+·00011	+·00015	+·00008	+·00002	+·00014	+·00009	+·00002	+·00003	+·00007
19 17 ..	+·00012	+·00002	+·00002	+·00016	+·00008	+·00020	+·00007	+·00011	+·00022	+·00013	+·00002	+·00010	+·00010
20 17 ...	+·00012	+·00007	+·00013	+·00024	+·00021	+·00026	+·00019	+·00020	+·00028	+·00015	+·00003	+·00006	+·00016
21 17 ...	+·00014	+·00013	+·00020	+·00033	+·00027	+·00033	+·00027	+·00027	+·00031	+·00022	+·00005	+·00008	+·00022
22 17 ...	+·00020	+·00021	+·00022	+·00044	+·00035	+·00040	+·00036	+·00032	+·00037	+·00032	+·00010	+·00013	+·00028
23 17 ...	+·00022	+·00025	+·00029	+·00049	+·00040	+·00040	+·00041	+·00037	+·00043	+·00033	+·00013	+·00014	+·00032
0 17 ...	+·00025	+·00027	+·00030	+·00050	+·00035	+·00044	+·00043	+·00040	+·00049	+·00031	+·00011	+·00011	+·00033
1 17 ...	+·00019	+·00024	+·00024	+·00042	+·00037	+·00045	+·00042	+·00037	+·00045	+·00028	+·00011	+·00009	+·00030
2 17 ...	+·00009	+·00022	+·00024	+·00040	+·00034	+·00047	+·00041	+·00039	+·00044	+·00023	+·00007	+·00007	+·00028
3 17 ...	+·00011	+·00014	+·00016	+·00033	+·00029	+·00035	+·00041	+·00036	+·00039	+·00017	+·00003	+·00002	+·00023
4 17 ...	+·00010	+·00014	+·00016	+·00027	+·00033	+·00041	+·00042	+·00041	+·00038	+·00015	−·00005	−·00001	+·00023
5 17 ...	+·00003	+·00011	+·00011	+·00031	+·00047	+·00065	+·00062	+·00059	+·00048	+·00018	−·00006	−·00006	+·00029
6 17 ...	+·00004	+·00013	+·00015	+·00075	+·00066	+·00091	+·00090	+·00101	+·00103	+·00029	−·00018	−·00014	+·00046
7 17 ...	+·00009	+·00008	+·00044	+·00051	+·00033	+·00067	+·00071	+·00066	+·00095	+·00051	−·00012	−·00016	+·00039
8 17 ...	+·00051	−·00011	+·00024	−·00040	−·00046	−·00009	+·00008	−·00032	−·00013	−·00001	−·00008	+·00015	−·00005
9 17 ...	+·00010	−·00050	−·00017	−·00143	−·00144	−·00099	−·00086	−·00141	−·00145	−·00084	−·00027	+·00011	−·00076
Average progressive increase *per* day ...	−·00004	+·00001	−·00008	−·00006	−·00022	+·00005	+·00005	−·00001	+·00009	−·00015	−·00004	+·00011	−·00002

Table 54.—Declination Magnetograph.

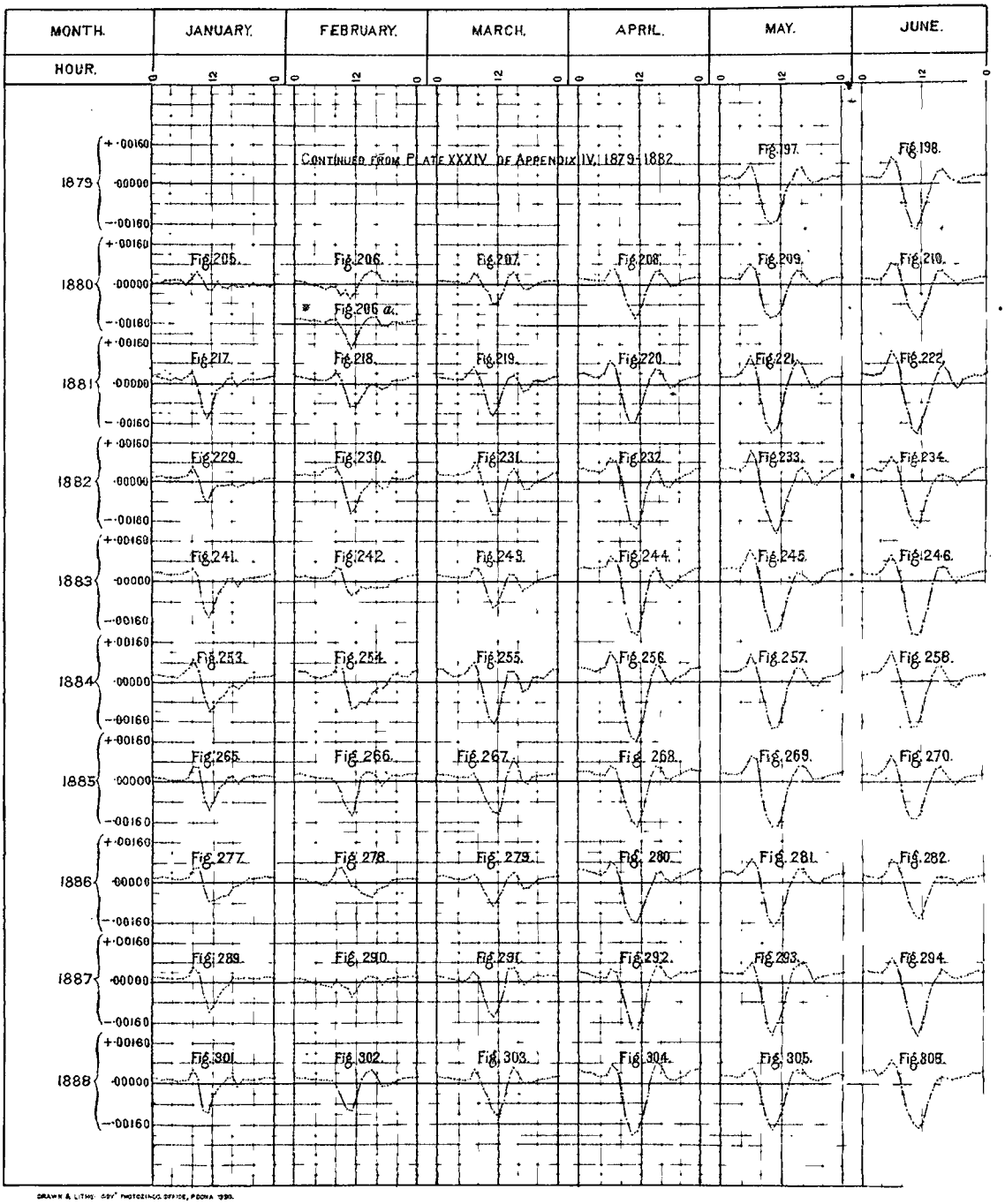
Showing, for the period 1878 to 1888, the mean diurnal variation of Declination for each month of the year and for the whole year.

Bombay Civil Time.		MONTH.												Year.
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h.	m.													
10	18 ...	+·00072	+·00066	+·00086	+·00019	−·00082	−·00035	−·00027	−·00073	−·00060	−·00020	−·00018	+·00008	−·00005
11	18 ...	−·00020	+·00007	−·00016	−·00119	−·00193	−·00163	−·00150	−·00197	−·00197	−·00114	−·00062	−·00021	−·00104
12	18 ...	−·00051	−·00033	−·00109	−·00202	−·00242	−·00238	−·00211	−·00250	−·00264	−·00140	−·00034	−·00010	−·00149
13	18 ...	−·00024	−·00024	−·00125	−·00193	−·00205	−·00227	−·00212	−·00236	−·00231	−·00092	+·00027	+·00025	−·00126
14	18 ...	−·00005	−·00009	−·00066	−·00122	−·00122	−·00167	−·00160	−·00165	−·00126	−·00021	+·00045	+·00033	−·00074
15	18 ...	+·00012	+·00012	+·00008	−·00042	−·00041	−·00094	−·00084	−·00064	−·00017	+·00036	+·00045	+·00030	−·00017
16	18 ...	+·00031	+·00014	+·00029	+·00013	+·00017	−·00029	−·00021	+·00016	+·00044	+·00044	+·00037	+·00034	+·00019
17	18 ...	+·00015	−·00007	−·00003	+·00011	+·00026	−·00002	+·00006	+·00040	+·00029	−·00007	+·00011	+·00020	+·00012
18	18 ...	+·00009	−·00015	−·00032	−·00019	−·00007	−·00011	+·00007	+·00003	−·00010	−·00015	+·00017	+·00023	−·00004
19	18 ...	+·00022	·00000	−·00026	−·00032	−·00036	−·00044	·00050	−·00029	−·00016	−·00008	+·00016	+·00028	−·00015
20	18 ...	+·00018	+·00004	−·00016	−·00027	−·00032	−·00039	−·00050	−·00031	−·00012	−·00003	+·00015	+·00023	−·00012
21	18 ...	+·00013	+·00005	−·00009	−·00012	−·00018	−·00026	−·00039	−·00022	−·00005	+·00001	+·00016	+·00021	−·00006
22	18 ...	+·00015	+·00009	−·00002	+·00002	−·00002	−·00004	−·00021	−·00010	+·00004	+·00013	+·00020	+·00021	+·00004
23	18 ...	+·00017	+·00016	+·00008	+·00013	+·00013	+·00011	−·00004	+·00002	+·00016	+·00024	+·00027	+·00023	+·00014
0	18 ..	+·00017	+·00016	+·00013	+·00023	+·00027	+·00026	+·00015	+·00015	+·00024	+·00025	+·00026	+·00023	+·00021
1	18 ...	+·00009	+·00014	+·00012	+·00030	+·00037	+·00038	+·00029	+·00023	+·00029	+·00024	+·00021	+·00016	+·00023
2	18 ...	−·00003	+·00006	+·00006	+·00029	+·00041	+·00045	+·00036	+·00031	+·00031	+·00016	+·00010	+·00002	+·00021
3	18 ...	−·00022	−·00008	−·00006	+·00019	+·00040	+·00046	+·00040	+·00035	+·00026	+·00002	−·00011	−·00017	+·00012
4	18 ...	−·00041	−·00025	−·00017	+·00012	+·00042	+·00050	+·00049	+·00043	+.00026	−·00010	−·00032	−·00038	+·00005
5	18 ...	−·00061	−·00044	−·00025	+·00015	+·00069	+·00087	+·00086	+·00077	+·00040	−·00016	−·00047	−·00060	+·00010
6	18 ...	−·00071	−·00052	−·00015	+·00087	+·00178	+·00200	+·00197	+·00200	+·00138	+·00008	−·00069	−·00074	+·00061
7	18 ...	−·00065	−·00045	+·00054	+·00175	+·00230	+·00254	+·00249	+·00273	+·00234	+·00081	−·00057	−·00094	+·00107
8	18 ...	+·00021	+·00020	+·00120	+·00190	+·00196	+·00223	+·00219	+·00229	+·00212	+·00109	−·00006	−·00040	+·00124
9	18 ...	+·00095	+·00070	+·00129	+·00133	+·00069	+·00101	+·00105	+·00086	+·00085	+·00060	+·00007	+·00020	+·00080

COLABA OBSERVATORY.

VERTICAL FORCE MAGNETOGRAPH. DIURNAL VARIATION.

Plate IV.



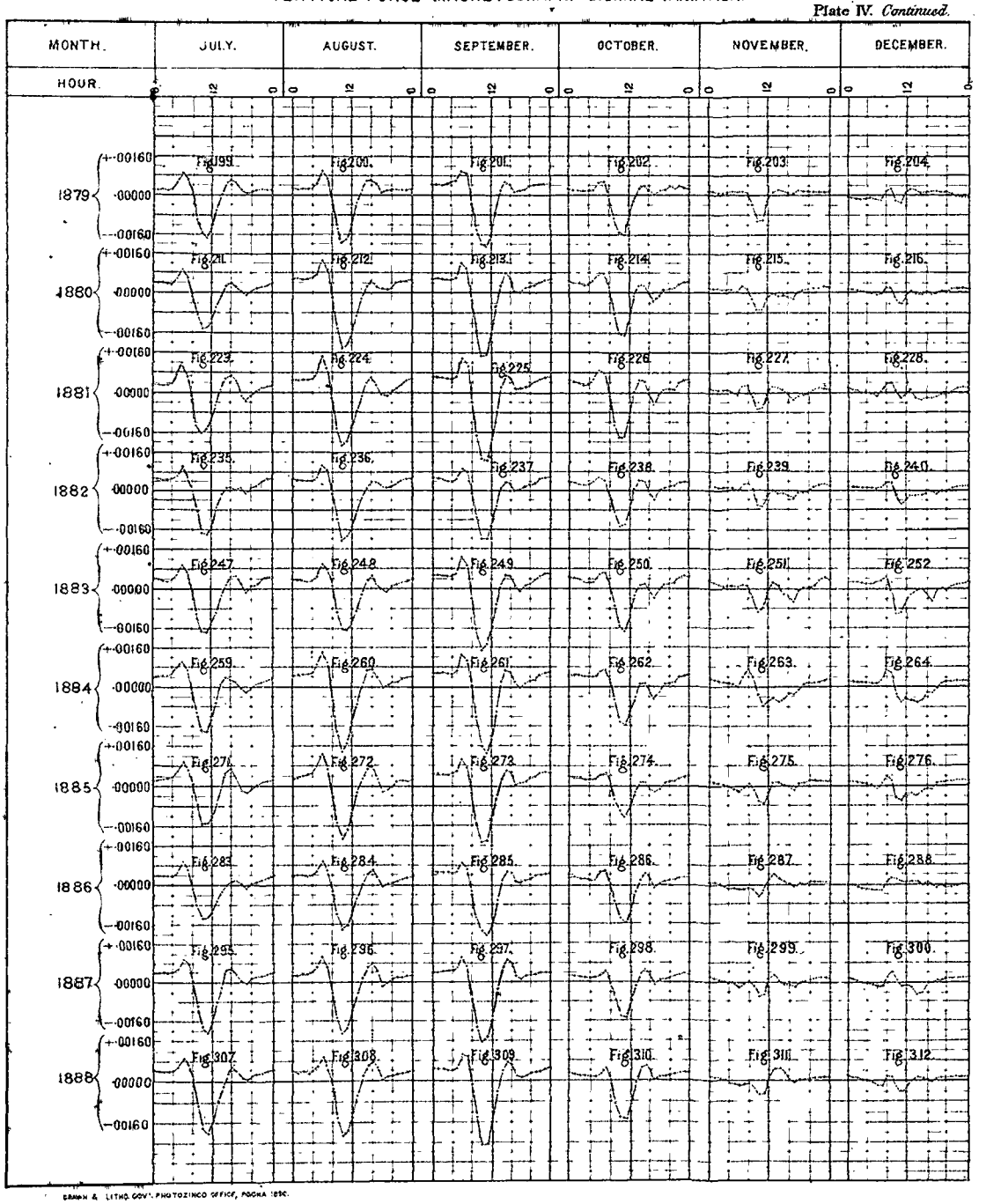
DRAWN & LITHO. AT THE PHOTOZINCO OFFICE, POONA 1890.

*See paragraph 61.

COLABA OBSERVATORY.

VERTICAL FORCE MAGNETOGRAPH. DIURNAL VARIATION.

Plate IV. *Continued.*



BEMAN & LITHO. GOV'T. PHOTOZINCO OFFICE, POONA 1896.

TABLE 55.—HORIZONTAL FORCE MAGNETOGRAPH.

Showing, for the period 1878 to 1888, the mean diurnal variation of Horizontal Force for each month of the year and for the whole year.

Bombay Civil Time.	MONTH.												Year.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h. m.													
10 19	+·00200	+·00253	+·00353	+·00359	+·00300	+·00308	+·00269	+·00233	+·00243	+·00287	+·00298	+·00218	+·00277
11 19	+·00235	+·00296	+·00390	+·00367	+·00315	+·00322	+·00301	+·00277	+·00281	+·00336	+·00305	+·00234	+·00305
12 19	+·00210	+·00279	+·00338	+·00306	+·00268	+·00286	+·00288	+·00276	+·00255	+·00290	+·00234	+·00191	+·00268
13 19	+·00147	+·00189	+·00224	+·00211	+·00196	+·00217	+·00234	+·00223	+·00191	+·00179	+·00128	+·00118	+·00188
14 19	+·00064	+·00092	+·00106	+·00099	+·00099	+·00107	+·00146	+·00129	+·00097	+·00070	+·00039	+·00048	+·00091
15 19	+·00008	+·00020	+·00007	+·00012	+·00011	+·00011	+·00042	+·00034	+·00012	−·00010	−·00028	−·00003	+·00010
16 19	−·00036	−·00041	−·00065	−·00059	−·00058	−·00074	−·00051	−·00048	−·00046	−·00063	−·00087	−·00045	−·00056
17 19	−·00060	−·00065	−·00089	−·00099	−·00098	−·00112	−·00098	−·00082	−·00067	−·00079	−·00113	−·00066	−·00086
18 19	−·00075	−·00084	−·00112	−·00126	−·00117	−·00132	−·00123	−·00102	−·00083	−·00100	−·00123	−·00082	−·00105
19 19	−·00090	−·00093	−·00131	−·00145	−·00127	−·00135	−·00125	−·00112	−·00102	−·00123	−·00135	−·00095	−·00118
20 19	−·00094	−·00111	−·00150	−·00155	−·00136	−·00141	−·00127	−·00121	−·00109	−·00139	−·00133	−·00113	−·00127
21 19	−·00101	−·00124	−·00156	−·00150	−·00130	−·00133	−·00125	−·00124	−·00112	−·00140	−·00135	−·00115	−·00129
22 19	−·00109	−·00135	−·00158	−·00144	−·00123	−·00125	−·00123	−·00118	−·00112	−·00140	−·00134	−·00106	−·00127
23 19	−·00102	−·00129	−·00147	−·00128	−·00112	−·00117	−·00118	−·00106	−·00100	−·00122	−·00113	−·00095	−·00116
0 19	−·00090	−·00112	−·00134	−·00124	−·00105	−·00109	−·00111	−·00097	−·00085	−·00103	−·00093	−·00090	−·00104
1 19	−·00084	−·00107	−·00124	−·00118	−·00102	−·00107	−·00109	−·00088	−·00076	−·00093	−·00087	−·00076	−·00098
2 19	−·00076	−·00100	−·00112	−·00109	−·00095	−·00106	−·00100	−·00078	−·00065	−·00083	−·00075	−·00066	−·00089
3 19	−·00068	−·00089	−·00101	−·00095	−·00094	−·00103	−·00096	−·00072	−·00053	−·00066	−·00067	−·00058	−·00080
4 19	−·00052	−·00077	−·00095	−·00087	−·00091	−·00098	−·00091	−·00062	−·00047	−·00055	−·00056	−·00053	−·00072
5 19	−·00039	−·00063	−·00087	−·00084	−·00082	−·00084	−·00081	−·00060	−·00043	−·00054	−·00049	−·00029	−·00063
6 19	−·00015	−·00048	−·00079	−·00074	−·00057	−·00047	−·00056	−·00059	−·00058	−·00056	−·00014	−·00010	−·00048
7 19	+·00022	·00000	−·00023	−·00022	+·00011	+·00030	+·00002	−·00034	−·00063	−·00012	+·00063	+·00041	+·00001
8 19	+·00074	+·00081	+·00102	+·00105	+·00113	+·00120	+·00081	+·00040	+·00008	+·00078	+·00147	+·00103	+·00088
9 19	+·00129	+·00178	+·00248	+·00259	+·00216	+·00227	+·00176	+·00149	+·00140	+·00195	+·00228	+·00155	+·00192
Average progressive increase *per day* ...	−·00008	−·00003	−·00006	−·00005	+·00005	−·00002	−·00004	−·00002	−·00005	−·00007	−·00005	−·00001	−·00004

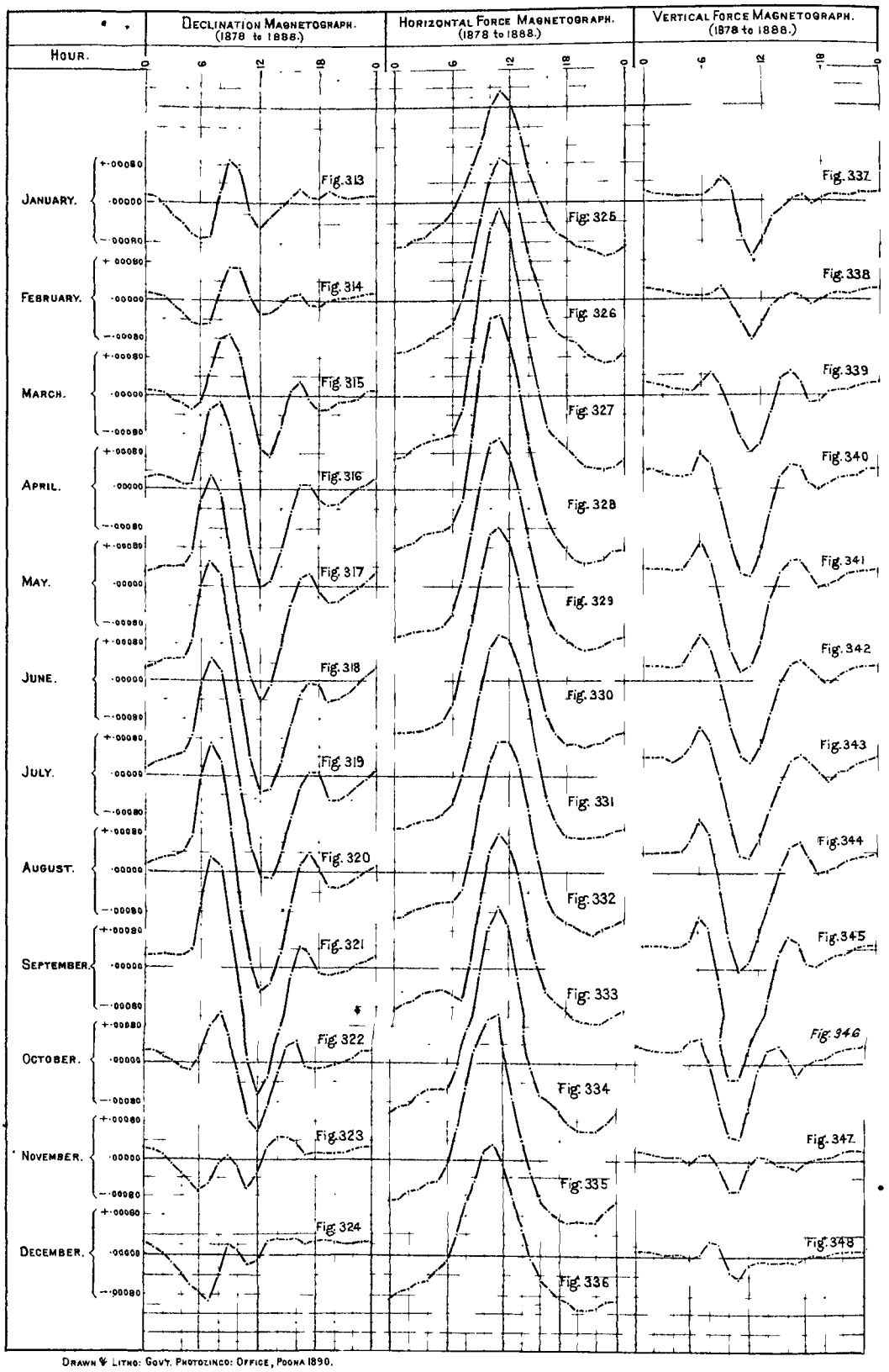
TABLE 56.—VERTICAL FORCE MAGNETOGRAPH.

Showing, for the period 1878 to 1888, the mean diurnal variation of Vertical Force for each month of the year and for the whole year.

Bombay Civil Time.	MONTH.												Year.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
h. m.													
10 17	−·00070	−·00049	−·00085	−·00173	−·00179	−·00158	−·00162	−·00202	−·00232	−·00146	−·00066	−·00031	−·00129
11 17	−·00112	−·00085	−·00119	−·00181	−·00166	−·00171	−·00169	−·00186	−·00232	−·00155	−·00063	−·00042	−·00140
12 17	−·00077	−·00056	−·00101	−·00129	−·00118	−·00134	−·00131	−·00131	−·00164	−·00089	−·00012	−·00018	−·00097
13 17	−·00033	−·00018	−·00035	−·00042	−·00036	−·00064	−·00069	−·00060	−·00062	−·00013	+·00015	−·00006	−·00035
14 17	−·00015	+·00001	+·00035	+·00026	+·00026	−·00004	−·00008	+·00005	+·00029	+·00032	+·00006	−·00010	+·00010
15 17	+·00002	+·00010	+·00053	+·00058	+·00055	+·00036	+·00036	+·00050	+·00068	+·00039	−·00003	−·00011	+·00033
16 17	+·00011	+·00004	+·00025	+·00050	+·00056	+·00046	+·00047	+·00064	+·00056	+·00008	−·00010	−·00006	+·00029
17 17	−·00004	−·00013	−·00014	+·00016	+·00027	+·00030	+·00033	+·00035	+·00012	−·00023	−·00019	−·00010	+·00006
18 17	+·00007	−·00004	−·00011	·00000	·00000	+·00005	+·00005	+·00001	+·00007	·00000	−·00001	·00000	+·00001
19 17	+·00015	+·00012	+·00008	+·00010	+·00002	−·00005	−·00010	+·00003	+·00021	+·00012	+·00004	+·00005	+·00006
20 17	+·00015	+·00014	+·00015	+·00022	+·00015	+·00011	+·00007	+·00014	+·00030	+·00016	+·00006	+·00003	+·00014
21 17	+·00015	+·00014	+·00016	+·00030	+·00025	+·00020	+·00018	+·00025	+·00036	+·00022	+·00012	+·00006	+·00020
22 17	+·00019	+·00018	+·00020	+·00036	+·00033	+·00030	+·00030	+·00032	+·00043	+·00035	+·00019	+·00010	+·00027
23 17	+·00019	+·00022	+·00026	+·00042	+·00035	+·00034	+·00034	+·00037	+·00049	+·00038	+·00022	+·00013	+·00031
0 17	+·00021	+·00023	+·00027	+·00044	+·00038	+·00037	+·00039	+·00041	+·00052	+·00038	+·00020	+·00013	+·00033
1 17	+·00018	+·00021	+·00024	+·00042	+·00037	+·00036	+·00039	+·00041	+·00052	+·00035	+·00018	+·00011	+·00031
2 17	+·00016	+·00018	+·00021	+·00037	+·00036	+·00034	+·00039	+·00042	+·00050	+·00032	+·00015	+·00008	+·00029
3 17	+·00013	+·00012	+·00015	+·00031	+·00033	+·00031	+·00029	+·00042	+·00047	+·00027	+·00008	+·00004	+·00024
4 17	+·00012	+·00009	+·00013	+·00029	+·00036	+·00037	+·00042	+·00046	+·00049	+·00027	+·00006	+·00003	+·00026
5 17	+·00011	+·00007	+·00012	+·00036	+·00058	+·00063	+·00065	+·00067	+·00061	+·00031	+·00005	+·00002	+·00035
6 17	+·00013	+·00006	+·00024	+·00078	+·00094	+·00101	+·00102	+·00117	+·00114	+·00054	−·00005	−·00002	+·00058
7 17	+·00023	+·00015	+·00046	+·00058	+·00056	+·00076	+·00072	+·00079	+·00088	+·00058	+·00014	+·00004	+·00049
8 17	+·00052	+·00024	+·00020	−·00018	−·00031	−·00001	−·00002	−·00024	−·00028	·00000	+·00017	+·00032	+·00003
9 17	+·00026	−·00005	−·00031	−·00105	−·00132	−·00091	−·00091	−·00132	−·00145	−·00080	−·00014	+·00024	−·00065
Average progressive increase *per* day... ...	+·00003	−·00009	−·00012	−·00008	−·00012	+·00001	+·00003	−·00003	−·00001	·00000	−·00002	−·00002	−·00004

COLABA OBSERVATORY. DIURNAL VARIATIONS.

Plate V.



DRAWN & LITHO: GOVT. PHOTOZINCO: OFFICE, POONA 1890.

COLABA OBSERVATORY. DIURNAL VARIATIONS.

Plate VI.

	DECLINATION MAGNETOGRAPH.	HORIZONTAL FORCE MAGNETOGRAPH.	VERTICAL FORCE MAGNETOGRAPH.
HOUR.	0 6 12 18 0	0 6 12 18 0	0 6 12 18 0

CONTINUED FROM PLATE XXXVI OF APPENDIX IV, 1879-1882.

1879 (+·00080 ·00000 −·00080)		Fig.356	Fig.365
1880 (+·00080 ·00000 −·00080)		Fig.357	Fig.366
1881 (+·00080 ·00000 −·00080)		Fig.358	Fig.367
1882 (+·00080 ·00000 −·00080)	Fig.349	Fig.359	Fig.368
1883 (+·00080 ·00000 −·00080)	Fig.350	Fig.360	Fig.369
1884 (+·00080 ·00000 −·00080)	Fig.351	Fig.361	Fig.370
1885 (+·00080 ·00000 −·00080)	Fig.352	Fig.362	Fig.371
1886 (+·00080 ·00000 −·00080)	Fig.353	Fig.363	Fig.372
1887 (+·00080 ·00000 −·00080)	Fig.354	Fig.364	Fig.373
1888 (+·00080 ·00000 −·00080)	Fig.355		Fig.374
YEAR (+·00080 ·00000 −·00080)	Fig.375	Fig.376	Fig.377
	1878 to 1888	1878 to 1888	1878 to 1888

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62. Appendix IV, 1879—82, paragraph 252. The variations being, however, slightly affected by the progressive change in the values of the ordinates from the beginning to the end of the month, or by the average of such changes for groups of months, the amounts of these changes *per* day are, after conversion into force, stated at the feet of the several columns of Tables 35 to 53, 55 and 56, so that allowance can, if desired, be made for them by the reader. In the case of the declination they are, however, quite insignificant in amount, and are therefore not entered.

63. Appendix IV, 1879—82, paragraph 253. The general character of the mean diurnal variations of declination, horizontal force, and vertical force is best exhibited by Figs. 375 to 377 of Plate VI.

64. Appendix IV, 1879—82, paragraph 254. *Change from month to month in the range of mean diurnal variations.*

TABLE 57.

Ranges expressed in force.

Month.	Declination Magnetograph.	Horizontal Force Magnetograph.	Vertical Force Magnetograph.
	1878 to 1888.	1878 to 1888.	1878 to 1888.
January	·00166	·00344	·00164
February	·00122	·00431	·00109
March	·00254	·00548	·00172
April	·00392	·00522	·00259
May	·00472	·00451	·00273
June...	·00492	·00463	·00272
July	·00461	·00428	·00271
August	·00523	·00401	·00319
September	·00498	·00393	·00346
October	·00249	·00476	·00213
November	·00114	·00440	·00088
December	·00128	·00349	·00074

On these numbers, and on the ranges of the corresponding curves of Plate V, we may repeat the remarks made in Appendix IV, 1879—82, paragraph 254, with reference to mean ranges of earlier periods, that the declination and vertical force ranges move generally together; that they both have maximum values about the autumnal equinox, and very low values from November to February, and that the intermediate progressions are similar in character. On the other hand, the maximum of the horizontal force range occurs about the vernal equinox, whilst the minimum occurs about the winter solstice, and from June to November it has a comparatively steady intermediate value.

65. Appendix IV, 1879—82, paragraph 255. *Change from year to year in the range of mean diurnal variations.*

TABLE 58.

Ranges expressed in force.

Year.	Declination Magnetograph.	Horizontal Force Magnetograph.	Vertical Force Magnetograph.
1871...	·00360	.....	.....
1872...	·00344	·00675	.....
1873...	·00317	·00542	·00177
1874...	·00248	·00481	·00184
1875...	·00250	·00407	·00178
1876...	·00242	·00392	·00201
1877...	·00275	·00366	·00221
1878...	·00243	·00357	·00196
1879...	·00249	·00377	·00186
1880...	·00248	·00432	·00173
1881...	·00316	·00499	·00221
1882...	·00272	·00474	·00216
1883...	·00307	·00502	·00218
1884...	·00322	·00523	·00240
1885...	·00289	·00488	·00195
1886...	·00241	·00400	·00156
1887...	·00261	·00379	·00190
1888...	·00254	·00367	·00190

The declination ranges are relatively large from 1871 to 1873, smaller from 1874 to 1880, again large from 1881 to 1885, and again smaller from 1886 to 1888—all in general accord with the sun-spot period: the horizontal force ranges also are relatively large from 1872 to 1874, smaller from 1875 to 1880, again large from 1881 to 1885, and again smaller from 1886 to 1888—in similar general accord: and since 1878 the vertical force ranges follow a similar progression, those for 1882 to 1885 being relatively large, whilst those before and after that period are relatively small, but the relatively small values that occur from 1873 to 1875, and relatively large values that occur from 1876 to 1878 seem rather to suggest opposition to, than agreement with, the sun-spot period. The subject is, however, well worth a closer examination with a view to tracing the progression through smaller intervals than full years.

66. Appendices II and III, 1879—82, paragraphs 150 and 234. Consulting the figures of Plate V, which represent the mean diurnal variations for each month of the year, we see that in every month those of horizontal force have a single progression of increase and decrease in the course of the day, from which and the general similarity of character of the curves we may conclude that the range from the least to the greatest inequality of the day is a phenomenon that is comparable throughout the year; but the curves of declination and vertical force exhibit generally double movements of increase and decrease in the course of the day, and vary so much in character during the year that ranges from the least to the greatest inequalities would not be comparable phenomena, and if we would here compare and trace growth and decay at all, it must be by selecting particular movements in the day's variation that correspond in character, and taking for comparison the ranges from the least to the greatest inequalities of those movements: moreover, the curves of the months December to February have so much smaller a range, and some of them differ so much in character from those of the rest of the year, that it is advisable to exclude the ranges of those months altogether from the inquiry. Confining the attention, then, to the curves of March to October, it will be seen that, in each case, they are—except as to range—much alike throughout, and the principal movement of the day is distinctly the fall from the earlier maximum to the next following minimum—the maximum of declination occurring about 8 hours and the minimum about 12 hours and the maximum of vertical force occurring about 6 hours and the minimum about 11 hours.

67. As a rule, the extremes of these movements are also the absolute maxima and minima of the mean day, and where not so it will be noted, in the tables of absolute ranges that follow, what were the hours of occurrence of the maximum and minimum inequalities, in individual months, of the movements in question, and what the range from one to the other.

68. The ranges from the least to the greatest inequality of the mean day for each month of the year are shown—for the declination magnetometer for the years 1846 to 1872 and for the declination magnetograph for the years 1871 to 1888 in Table 59; for the horizontal force magnetometer for the years 1847 to 1872, and for the horizontal force magnetograph for the years 1872 to 1888 in Table 60; and for the vertical force magnetograph for the years 1873 to 1888 in Table 61. Of these, the numbers of Table 60, of horizontal force ranges, are immediately available for finding annual mean ranges corresponding to the times $1847\frac{6}{12}$, $1847\frac{7}{12}$, $1847\frac{8}{12}$, &c., &c., up to $1872\frac{6}{12}$, by taking 1st the mean of the first and eleven following numbers, 2nd the mean of the second and eleven following numbers, and so on; and similarly for finding the annual mean ranges for the period 1872 to 1888: the resulting annual means, of which there are twelve to a year, are shown in Table 63. The numbers of Tables 59 and 61 require to be modified, first by the omission of all those for the months January, February, November and December, and then by substitution of the ranges shown in the foot-notes for months in which the absolute ranges are not identical with the ranges between the earlier maximum and the next following minimum inequality: but these changes having been made, the mean of the first and seven following numbers of declination ranges corresponds to the time $1846\frac{4}{8}$, the mean of the second and seven following numbers to the time $1846\frac{5}{8}$, and so on up to $1872\frac{4}{8}$; and similarly the means for the period 1871 to 1888 correspond to the times $1871\frac{4}{8}$, $1871\frac{5}{8}$, $1871\frac{6}{8}$, &c., &c. And, in the same manner, means are obtained for each eighth of a year of the period 1873 to 1888 of ranges of the vertical force. These last are exhibited in Table 64, and the means of declination in Table 62. The numbers of Tables 62 to 64 are curved, in the usual manner, in Figs. 378, 378*a*, 379, 379*a* and 380 respectively of Plate VII. It will be observed that, by the nature of the process of reduction, any annual variation that affects the ranges is, in each case, eliminated in the numbers of Tables 62 to 64.

COLABA OBSERVATORY.

SECULAR VARIATIONS OF THE DIURNAL RANGE OF DECLINATION, HORIZONTAL FORCE AND VERTICAL FORCE, A SIX VARIATIONS IN PERIOD OF 78 YEARS.

Plate VII

DECLINATION MAGNETOMETER.

DECLINATION MAGNETOGRAPH.

HORIZONTAL FORCE MAGNETOMETER.

HORIZONTAL FORCE MAGNETOGRAPH.

VERTICAL FORCE MAGNETOGRAPH.

SECULAR VARIATIONS OF THE DIURNAL RANGE OF DECLINATION, HORIZONTAL FORCE AND VERTICAL FORCE AFTER ELIMINATING VARIATIONS IN A PERIOD OF ABOUT 11 YEARS

DECLINATION

HORIZONTAL FORCE

VERTICAL FORCE

TABLE 59.—*Range of mean diurnal variation of Declination.*

DECLINATION MAGNETOMETER.

Year.	Month.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1846... ...	·00203	·00256	·00286	·00464	·00517	·00507	·00489	·00644	·00603	·00319	·00172	·00168
1847... ...	·00123	·00191	·00292	·00479	·00474	·00526	·00533	·00546	·00579	·00396	·00111	·00154
1848... ...	·00255	·00166	00409	·00483	·00554	·00562	·00633	·00656	·00694	·00322	00150	·00201
1849... ...	·00264	·00324	·00391	00504	·00598	·00572	·00572	·00658	·00629	·00282	·00125	·00146
1850... ...	·00209	·00220	·00315	·00489	·00592	·00578	·00580	·00534	·00616	·00318	·00137	·00182
1851... ...	·00250	·00145	·00267	·00424	·00485	·00510	·00521	·00477	·00565	·00328	·00179	·00138
1852... ...	·00223	·00184	·00302	·00538	·00529	·00542	·00528	·00616	·00439	·00283	·00193	·00210
1853	·00254	·00116	·00212	·00509	00510	·00562	·00597	·00675	·00675	·00204	·00134	·00158
1854... ...	·00170	·00142	·00224	·00412	·00497	·00469	·00456	·00499	·00181	·00240	·00131	·00136
1855... ...	·00198	·00187	·00250	·00453	·00493	·00433	·00407	·00436	·00386	·00254	·00192	·00197
1856... ...	·00249	·00132	·00228	·00391	·00373	·00443	·00418	·00527	·00538	·00239	·00145	·00172
1857... ...	·00167	·00214	·00167	·00353	·00502	·00409	·00412	·00498	·00667	·00305	·00112	·00160
1858... ...	·00245	·00145	·00347	·00491	·00570	·00503	·00504	·00645	·00603	·00197	·00133	·00188
1859... ...	·00311	·00187	·00364	·00599	·00658	·00615	·00516	·00608	·00683	·00387	·00158	·00266
1860... ...	·00240	·00220	·00330	·00530	·00618	·00546	·00601	·00830	·00642	·00400	·00148	·00148
1861... ...	·00245	·00206	·00376	·00466	·00537	·00559	·00538	·00727	·00701	·00266	·00140	·00200
1862... ...	·00238	·00221	·00373	·00512	·00491	·00568	·00488	·00574	·00569	·00280	·00125	·00242
1863... ...	·00454	·00105	·00275	·00449	·00603	·00513	·00561	·00543	·00469	·00279	·00171	·00170
1864... ...	·00194	·00161	·00309	·00438	·00480	·00545	·00491	·00597	·00589	·00224	·00117	·00165
1865... ...	·00219	·00150	·00264	·00410	·00515	·00480	·00431	·00378	·00495	·00252	·00174	·00133
1866... ...	·00172	·00124	·00263	·00437	·00388	·00413	·00355	·00403	·00443	·00321	·00157	·00195
1867... ...	·00223	·00131	·00253	·00425	·00428	·00433[a]	·00468	·00444	·00424	·00266[b]	·00149	·00160
1868... ...	·00130	·00214	·00256	·00468	·00453	·00508	·00382	·00542	·00547	·00199	·00105	·00105
1869... ...	·00203	·00102	·00268	·00476	·00537	·00652	·00611	·00594	·00624	·00293	·00136	·00235
1870... ...	·00179	·00298	·00322	·00558	·00547	·00675	·00680	·00778	·00704	·00344	·00203	·00109
1871... ...	·00211	·00233	·00416	·00593	·00599	·00575	·00672	·00757	·00672	·00392	·00160	·00161
1872... ...	·00250	·00255	·00417	·00537	·00669	·00544	·00566	·00644	·00647	·00453	·00148	·00167

DECLINATION MANGNETOGRAPH.

1871	·00239	·00196	·00367	·00581	·00600	·00677	·00631	·00733	·00662	·00357	·00174	·00180
1872... ...	·00283	·00239	·00379	·00516	·00549	·00550	·00578	·00669	·00706	·00330	·00168	·00174
1873... ...	·00230	·00174	·00382	·00488	·00535	·00454	·00538	·00612	·00569	·00208	·00122	·00143
1874... ...	·00221	·00178	·00293	·00398	·00445	·00414	·00420	·00511	·00548	·00243	·00124	·00143
1875... ...	·00177	·00186	·00221	·00321	·00489	·00411	·00343	·00476	·00524	·00218	·00140	·00130
1876... ...	·00168	·00118	·00209	·00299	·00430	·00455	·00433	·00479	·00589	·00252	·00103	·00137
1877... ...	·00193	·00103	·00208	·00368	·00427	·00449	·00476	·00505	·00527	·00227	·00112	·00149
1878... ...	·00159	·00112	·00243	·00383	·00387	·00399	·00389	·00384	·00413	·00210[c]	·00115	·00184
1879... ...	·00160	·00103	·00216	·00281	·00443	·00477	·00453	·00497	·00462	·00231	·00172	·00181
1880... ...	·00150	·00141	·00231	·00349	·00440	·00465	·00415	·00484	·00478	·00262	·00113	·00150
1881... ...	·00191	·00153	·00275	·00400	·00543	·00572	·00516	·00584	·00572	·00328	·00122	·00153
1882... ...	·00169	·00200	·00312	·00412	·00487	·00468	·00375	·00508	·00432	·00273	·00162	·00132
1883... ...	·00212	·00157	·00237	·00422	·00514	·00551	·00519	·00485	·00566	·00296	·00153	·00180
1884... ...	·00240	·00278	·00348	·00525	·00525	·00549	·00501	·00624	·00565	·00266	·00195	·00210
1885... ...	·00232	·00134	·00275	·00405	·00518	·00538	·00533	·00647	·00533	·00202	·00134	·00159
1886... ...	·00225	·00196	·00226	·00380	·00494	·00478	·00437	·00509	·00467	·00270	·00131	·00181
1887	·00212	·00122	·00240	·00394	·00491	·00462	·00510	·00582	·00526	·00214	·00147	·00154
1888... ...	·00160	·00148	·00265	·00385	·00384	·00456	·00468	·00478	·00465	·00223	·00140	·00149

a (1867 June) Range from maximum at 7 h. to minimum at 13 h. = ·00411
b (,, October) ,, ,, 8 ,, 13 = ·00246
c (1878 ,,) ,, ,, 7 ,, 11 = ·00222

TABLE 60.—*Range of mean diurnal variation of Horizontal Force.*

HORIZONTAL FORCE MAGNETOMETER.

Year.	Month.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1847... ..	·00565	·00619	·00605	·00580	·00558	·00551	·00572	·00590	·00547	·00760	·00716	·00727
1848... ...	·00749	·00724	·00817	·00810	·00637	·00630	·00745	·00637	·00547	·00763	·00763	·00778
1849	·00796	·00940	·00817	·00871	·00734	·00619	·00569	·00511	·00511	·00623	·00709	·00634
1850... ..	·00644	·00691	·00756	·00641	·00536	·00583	·00547	·00439	·00493	·00727	·00605	·00454
1851... ...	·00619	·00641	·00709	·00662	·00702	·00587	·00529	·00464	·00576	·00562	·00652	·00612
1852... ...	·00533	·00612	·00590	·00634	·00598	·00601	·00461	·00468	·00432	·00562	·00616	·00518
1853... ...	·00620	·00642	·00704	·00664	·00584	·00533	·00489	·00537	·00471	·00631	·00620	·00580
1854... ...	·00544	·00577	·00577	·00533	·00544	·00467	·00537	·00401	·00361	·00588	·00551	·00460
1855... ...	·00471	·00474	·00617	·00518	·00577	·00383	·00442	·00434	·00434	·00577	·00526	·00449
1856... ...	·00580	·00555	·00585	·00589	·00543	·00467	·00496	·00530	·00518	·00633	·00587	·00542
1857	·00522	·00601	·00618	·00544	·00556	·00550	·00528	·00538	·00460	·00674	·00618	·00698
1858... ...	·00659	·00665	·00743	·00738	·00687	·00647	·00653	·00670	·00743	·00833	·00777	·00619
1859... ...	·00662	·00830	·00914	·00965	·00853	·00768	·00707	·00690	·00746	·00841	·00847	·00763
1860... ..	·00751	·00774	·00858	·00785	·00875	·00712	·00763	·00892	·00651	·00791	·00842	·00673
1861... ...	·00598	·00849	·00861	·00895	·00732	·00777	·00699	·00626	·00638	·00755	·00654	·00621
1862... ...	·00640	·00657	·00785	·00768	·00630	·00607	·00663	·00679	·00580	·00685	·00780	·00641
1863... ...	·00439	·00629	·00745	·00689	·00740	·00512	·00561	·00495	·00539	·00651	·00650	·00584
1864... ...	·00611	·00600	·00660	·00693	·00539	·00555	·00550	·00527	·00605	·00616	·00616	·00533
1865... ...	·00599	·00642	·00626	·00693	·00637	·00471	·00532	·00398	·00504	·00665	·00626	·00577
1866... ...	·00459	·00724	·00614	·00664	·00587	·00509	·00448	·00481	·00399	·00514	·00519	·00597
1867... ...	·00509	·00592	·00630	·00564	·00509	·00531	·00476	·00403	·00537	·00536	·00581	·00498
1868... ...	·00485	·00508	·00663	·00497	·00541	·00541	·00552	·00475	·00419	·00596	·00569	·00569
1869... ...	·00550	·00572	·00638	·00589	·00677	·00731	·00621	·00561	·00764	·00693	·00704	·00578
1870... ...	·00495	·00748	·00885	·01040	·01012	·00896	·00831	·00770	·01050	·01039	·00847	·00776
1871... ...	·00671	·00875	·00979	·01001	·00880	·00880	·00787	·00687	·00809	·00930	·00924	·00682
1872... ...	·00597	·00774	·00812	·00955	·00901	·00720	·00681	·00741	·00769	·00768	·00796	·00686

HORIZONTAL FORCE MAGNETOGRAPH.

1872... ...	·00590	·00927	·00780	·00853	·00765	·00635	·00668	·00537	·00660	·00649	·00655	·00567
1873... ...	·00551	·00702	·00756	·00775	·00513	·00476	·00495	·00539	·00536	·00497	·00429	·00387
1874... ...	·00459	·00592	·00601	·00618	·00511	·00466	·00500	·00485	·00460	·00415	·00437	·00370
1875... ...	·00332	·00484	·00548	·00578	·00431	·00436	·00386	·00378	·00332	·00375	·00380	·00291
1876... ...	·00406	·00393	·00518	·00480	·00438	·00369	·00430	·00354	·00289	·00389	·00389	·00316
1877... ...	·00355	·00354	·00450	·00471	·00410	·00377	·00382	·00354	·00330	·00421	·00310	·00306
1878... ..	·00240	·00336	·00459	·00464	·00386	·00403	·00349	·00366	·00316	·00358	·00414	·00305
1879... ...	·00255	·00355	·00481	·00053	·00415	·00394	·00381	·00335	·00370	·00408	·00375	·00370
1880... ...	·00391	·00392	·00481	·00502	·00424	·00444	·00382	·00451	·00464	·00556	·00416	·00365
1881... ...	·00437	·00499	·00595	·00521	·00499	·00562	·00569	·00503	·00480	·00543	·00472	·00424
1882... ...	·00329	·00461	·00652	·00620	·00556	·00499	·00532	·00464	·00439	·00548	·00571	·00400
1883... ...	·00382	·00513	·00565	·00616	·00454	·00519	·00543	·00488	·00441	·00517	·00532	·00405
1884... ...	·00439	·00529	·00723	·00699	·00485	·00577	·00463	·00448	·00422	·00559	·00527	·00355
1885... ...	·00359	·00540	·00611	·00671	·00511	·00574	·00540	·00429	·00435	·00562	·00478	·00352
1886	·00374	·00430	·00613	·00500	·00499	·00403	·00341	·00350	·00349	·00423	·00442	·00284
1887... ...	·00279	·00392	·00450	·00463	·00384	·00408	·00419	·00399	·00371	·00422	·00389	·00341
1888... ...	·00399	·00359	·00476	·00435	·00392	·00396	·00331	·00324	·00349	·00392	·00343	·00299

TABLE 61.—*Range of mean diurnal variation of Vertical Force.*

VERTICAL FORCE MAGNETOGRAPH.

Year.	Month.											
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1873... ...	·00162	·00173	·00200a	·00227	·00244b	·00260	·00276	·00290	·00348	·00195c	·00076	·00107
1874... ...	·00111	·00074	·00171	·00225	·00281	·00240	·00289	·00300	·00352	·00203	·00105	·00085
1875... ..	·00219	·00155	·00124d	·00174	·00248	·00249	·00223	·00261	·00341	·00193e	·00111	·00057
1876... ...	·00163	·00143	·00157f	·00184	·00256	·00278	·00244	·00335	·00388	·00281g	·00175	·00087
1877... ...	·00200	·00167	·00221h	·00281i	·00278	·00281	·00290	·00357	·00384	·00206j	·00080	·00171
1878... ...	·00207	·00142	·00227k	·00282l	·00241	·00248	·00280	·00272	·00353	·00210m	·00069	·00116
1879... ...	·00187	·00104	·00149n	·00199	·00236	·00280	·00263	·00295	·00319	·00217	·00135	·00059
1880... ...	·00075	·00115	·00123o	·00199	·00208	·00227	·00245	·00356	·00372	·00242	·00104	·00064
1881... ..	·00185	·00141	·00197	·00248	·00307	·00326	·00279	·00365	·00409	·00268	·00099	·00067
1882... ...	·00148	·00187	·00207	·00287	·00327	·00295	·00291	·00318	·00302	·00215	·00104	·00091
1883...	·00196	·00107	·00153	·00312	·00322	·00278	·00272	·00270	·00372	·00242	·00142	·00155
1884...	·00202	·00180	·00242	·00353	·00307	·00305	·00287	·00405	·00396	·00230	·00150	·00135
1885...	·00173	·00167	·00213p	·00250	·00279	·00254	·00255	·00332	·00341	·00177	·00103	·00105
1886...	·00138	·00116	·00128q	·00242	·00266	·00222	·00233	·00273	·00298	·00213	·00083	·00047
1887...	·00182	·00086	·00205r	·00252s	·00290	·00302	·00312	·00315	·00355	·00208t	·00088	·00086
1888...	·00164	·00150	·00189u	·00283v	·00243	·00266	·00288	·00309	·00347	·00225w	·00103	·00055

			h		h	
a (1873, March)	Range from maximum at	7	to minimum at	11	=	·00171
b (,, May)	,,	,,	6	,,	9	= ·00230
c (,, October)	,,	,,	6	,,	10	= ·00182
d (1875, March)	,,	,,	7	,,	11	= ·00117
e (,, October)	,,	,,	6	,,	10	= ·00183
f (1876, March)	,,	,,	7	,,	11	= ·00162
g (,, October)	,,	,,	6	,,	11	= ·00266
h (1877, March)	,,	,,	8	,,	11	= ·00168
i (,, April)	,,	,,	6	,,	11	= ·00276
j (,, October)	,,	,,	6	,,	10	= ·00209
k (1878, March)	,,	,,	7	,,	11	= ·00168
l (,, April)	,,	,,	6	,,	10	= ·00266
m (,, October)	,,	,,	6	,,	10	= ·00190
n (1879, March)	,,	,,	7	,,	11	= ·00109
o (1880, March)	,,	,,	7	,,	11	= ·00119
p (1885, March)	,,	,,	7	,,	12	= ·00163
q (1886, March)	,,	,,	7	,,	11	= ·00125
r (1887, March)	,,	,,	7	,,	11	= ·00189
s (,, April)	,,	,,	6	,,	11	= ·00239
(,, October)	,,	,,	7	,,	11	= ·00197
u (1888, March)	,,	,,	7	,,	11	= ·00160
,, April)	,,	,,	6	,,	10	= ·00277
,, October)	,,	,,	7	,,	11	= ·00205

TABLE 62.—*Secular variation of the diurnal range of Declination.*

Year.	Eighths of a year.							
	0	1	2	3	4	5	6	7
DECLINATION MAGNETOMETER.								
1846 ...					·00479	·00479	·00481	·00476
1847 ...	·00478	00484	·00471	·00468	·00478	·00493	·00493	·00503
1848 ...	·00508	·00520	·00534	·00548	·00539	·00537	·00539	·00545
1849 ...	·00546	·00539	·00539	·00531	·00526	·00516	·00514	·00514
1850 ...	·00514	·00515	·00500	·00498	·00503	·00497	·00489	·00475
1851 ...	·00467	·00459	·00452	·00446	·00447	·00451	·00466	·00471
1852 ...	·00475	·00476	·00493	·00478	·00472	·00461	·00457	·00455
1853 ...	·00457	·00466	·00473	·00503	·00493	·00494	·00482	·00481
1854 ...	·00469	·00451	·00429	·00405	·00410	·00413	·00418	·00418
1855 ...	·00413	·00407	·00399	·00412	·00414	·00411	·00403	·00388
1856 ...	·00390	·00391	·00402	·00396	·00395	·00387	·00382	·00398
1857 ...	·00394	·00393	·00390	·00406	·00414	·00437	·00454	·00462
1858 ...	·00474	·00486	·00504	·00496	·00495	·00497	·00511	·00522
1859 ...	·00536	·00537	·00532	·00542	·00554	·00549	·00541	·00536
1860 ...	·00540	·00550	·00578	·00573	·00575	·00580	·00572	·00562
1861 ...	·00551	·00543	·00531	·00538	·00521	·00521	·00527	·00521
1862 ...	·00522	·00516	·00497	·00480	·00482	·00470	·00462	·00476
1863 ...	·00469	·00478	·00474	·00462	·00461	·00466	·00464	·00449
1864 ...	·00453	·00444	·00451	·00466	·00459	·00453	·00450	·00454
1865 ...	·00446	·00439	·00424	·00437	·00416	·00415	·00419	·00403
1866 ...	·00395	·00385	·00376	·00369	·00378	·00377	·00375	·00380
1867 ...	·00380	·00394	·00399	·00397	·00387	·00388	·00393	·00396
1868 ...	·00408	·00398	·00410	·00425	·00419	·00421	·00422	·00432
1869 ...	·00450	·00479	·00485	·00495	·00507	·00514	·00524	·00525
1870 ...	·00528	·00537	·00560	·00582	·00613	·00625	·00630	·00636
1871 ...	·00636	·00635	·00632	·00616	·00597	·00597	·00590	·00599
1872 ...	·00582	·00569	·00555	·00561	·00568			
DECLINATION MAGNETOGRAPH.								
1871 ...					·00576	·00577	·00569	·00575
1872 ...	·00560	·00553	·00545	·00550	·00547	·00547	·00544	·00530
1873 ...	·00518	·00513	·00506	·00488	·00473	·00462	·00451	·00440
1874 ...	·00435	·00420	·00407	·00405	·00409	·00400	·00390	·00396
1875 ...	·00395	·00386	·00381	·00378	·00375	·00374	00371	·00364
1876 ...	·00369	·00380	·00381	·00389	·00393	·00393	·00402	·00401
1877 ..	·00401	·00406	·00417	·00409	·00406	·00410	·00412	00407
1878 ...	·00401	·00390	·00367	·00353	·00352	·00349	·00336	·00343
1879 ...	·00353	·00361	·00375	·00381	·00382	·00384	·00393	·00388
1880 ...	·00387	·00382	·00380	·00382	·00386	·00392	·00398	·00415
1881 ...	·00429	·00441	·00454	·00465	·00474	·00478	·00480	·00473
1882 ...	·00460	·00442	·00433	·00415	·00408	·00399	·00400	·00404
1883 ...	·00414	·00432	·00429	·00446	·00449	·00463	·00475	·00477
1884 ...	·00477	·00474	·00492	·00492	·00488	·00479	·00464	·00463
1885 ...	·00461	·00465	·00468	·00464	·00456	·00450	·00447	·00444
1886 ...	·00437	·00425	·00407	·00399	·00408	·00409	·00411	·00411
1887 ...	·00409	·00418	·00427	·00434	·00427	·00430	·00429	·00416
1888 ...	·00415	·00410	·00397	·00389	·00390			

TABLE 63.—*Secular variation of the diurnal range of Horizontal Force.*

HORIZONTAL FORCE MAGNETOMETER.

Year.	Twelfths of a year.											
	0	1	2	3	4	5	6	7	8	9	10	11
1847 ...							·00616	·00631	·00640	·00658	·00677	·00683
1848 ...	·00690	·00704	·00708	·00708	·00708	·00712	·00717	·00721	·00739	·00739	·00744	·00752
1849 ...	·00751	·00736	·00726	·00723	·00711	·00706	·00694	·00682	·00661	·00656	·00637	·00620
1850 ...	·00617	·00615	·00609	·00608	·00617	·00608	·00593	·00591	·00587	·00583	·00585	·00598
1851 ...	·00599	·00597	·00599	·00606	·00592	·00596	·00610	·00602	·00600	·00590	·00588	·00579
1852 ...	·00580	·00575	·00575	·00563	·00563	·00560	·00552	·00559	·00562	·00571	·00574	·00573
1853 ...	·00567	·00569	·00575	·00578	·00584	·00584	·00590	·00583	·00578	·00567	·00556	·00553
1854 ...	·00547	·00551	·00540	·00531	·00527	·00522	·00512	·00506	·00497	·00500	·00499	·00502
1855 ...	·00495	·00487	·00490	·00496	·00495	·00493	·00492	·00501	·00508	·00505	·00511	·00508
1856 ...	·00515	·00520	·00528	·00535	·00539	·00544	·00552	·00547	·00551	·00554	·00550	·00551
1857 ...	·00558	·00561	·00561	·00557	·00560	·00563	·00576	·00587	·00592	·00603	·00619	·00630
1858 ...	·00638	·00648	·00659	·00683	·00696	·00709	·00703	·00703	·00717	·00731	·00750	·00764
1859 ...	·00774	·00778	·00780	·00780	·00781	·00787	·00799	·00806	·00802	·00797	·00782	·00784
1860 ...	·00779	·00784	·00801	·00793	·00788	·00788	·00781	·00768	·00774	·00774	·00783	·00772
1861 ...	·00777	·00772	·00749	·00748	·00745	·00730	·00725	·00729	·00713	·00707	·00696	·00687
1862 ...	·00673	·00670	·00675	·00670	·00664	·00675	·00676	·00659	·00657	·00654	·00647	·00656
1863 ...	·00648	·00640	·00625	·00621	·00618	·00608	·00603	·00617	·00615	·00608	·00608	·00591
1864 ...	·00595	·00594	·00597	·00602	·00599	·00596	·00592	·00591	·00595	·00592	·00592	·00600
1865 ...	·00593	·00591	·00581	·00572	·00576	·00577	·00581	·00569	·00576	·00575	·00573	·00568
1866 ...	·00572	·00565	·00571	·00563	·00550	·00541	·00543	·00547	·00536	·00537	·00529	·00523
1867 ...	·00524	·00527	·00520	·00532	·00534	·00539	·00530	·00528	·00521	·00524	·00519	·00521
1868 ...	·00522	·00528	·00534	·00525	·00530	·00529	·00535	·00540	·00545	·00543	·00551	·00562
1869 ...	·00578	·00584	·00591	·00620	·00628	·00639	·00640	·00635	·00650	·00670	·00708	·00736
1870 ...	·00750	·00767	·00785	·00808	·00837	·00849	·00866	·00880	·00891	·00899	·00896	·00885
1871 ...	·00883	·00880	·00873	·00853	·00843	·00850	·00842	·00844	·00836	·00822	·00818	·00820
1872 ...	·00806	·00798	·00802	·00799	·00785	·00775	·00775					

HORIZONTAL FORCE MAGNETOGRAPH.

1872 ...							·00699	·00696	·00677	·00675	·00668	·00647
1873 ...	·00634	·00620	·00611	·00601	·00588	·00570	·00555	·00547	·00538	·00525	·00512	·00512
1874 ...	·00511	·00511	·00507	·00500	·00494	·00494	·00493	·00482	·00473	·00469	·00465	·00459
1875 ...	·00456	·00447	·00438	·00427	·00424	·00419	·00413	·00419	·00411	·00409	·00400	·00399
1876 ...	·00393	·00397	·00395	·00391	·00392	·00393	·00395	·00391	·00388	·00382	·00381	·00381
1877 ...	·00382	·00378	·00378	·00381	·00384	·00377	·00377	·00367	·00366	·00366	·00366	·00364
1878 ...	·00366	·00363	·00364	·00363	·00358	·00366	·00366	·00368	·00369	·00371	·00370	·00372
1879 ...	·00372	·00374	·00372	·00376	·00380	·00377	·00383	·00394	·00397	·00397	·00401	·00402
1880 ...	·00406	·00406	·00416	·00424	·00436	·00439	·00439	·00443	·00452	·00461	·00463	·00469
1881 ...	·00479	·00494	·00499	·00500	·00499	·00504	·00509	·00500	·00496	·00501	·00509	·00514
1882 ...	·00509	·00506	·00503	·00499	·00500	·00508	·00506	·00510	·00515	·00507	·00507	·00499
1883 ...	·00500	·00501	·00503	·00503	·00509	·00514	·00515	·00519	·00521	·00534	·00541	·00553
1884 ...	·00558	·00551	·00548	·00547	·00542	·00533	·00529	·00522	·00523	·00514	·00511	·00504
1885 ...	·00503	·00510	·00508	·00509	·00509	·00505	·00505	·00506	·00497	·00497	·00483	·00474
1886 ...	·00460	·00443	·00436	·00429	·00418	·00415	·00409	·00401	·00398	·00384	·00381	·00380
1887 ...	·00380	·00387	·00391	·00393	·00393	·00388	·00393	·00403	·00400	·00402	·00400	·00401
1888 ...	·00400	·00392	·00386	·00384	·00382	·00378	·00375					

TABLE 64.—*Secular variation of the diurnal range of Vertical Force.*

Year.	VERTICAL FORCE MAGNETOGRAPH. Eighths of a year.							
	0	1	2	3	4	5	6	7
1873	...				·00248	·00248	·00248	·00254
1874	·00252	·00253	·00254	·00255	·00258	·00251	·00244	·00240
1875	·00241	·00233	·00228	·00227	·00225	·00229	·00231	·00232
1876	·00235	·00238	·00247	·00253	·00263	·00265	·00276	·00279
1877	·00279	·00285	·00288	·00287	·00279	·00279	·00278	·00273
1878	·00269	·00268	·00257	·00253	·00253	·00246	·00238	·00237
1879	·00241	·00239	·00242	·00237	·00240	·00241	·00241	·00237
1880	·00231	·00229	·00236	·00243	·00246	·00256	·00262	·00274
1881	·00287	·00291	·00292	·00297	·00300	·00301	·00306	·00308
1882	·00305	·00306	·00300	·00287	·00280	·00273	·00277	·00276
1883	·00274	·00271	·00265	·00274	·00278	·00289	·00294	·00292
1884	·00295	·00297	·00314	·00317	·00316	·00306	·00293	·00289
1885	·00283	·00279	·00270	·00263	·00256	·00252	·00251	·00249
1886	·00245	·00242	·00235	·00229	·00234	·00241	·00240	·00243
1887	·00253	·00263	·00269	·00276	·00274	·00271	·00276	·00270
1888	·00266	·00263	·00262	·00261	·00262			

69. Of the secular variations of diurnal range, we see from the curves of Plate VII, that those of horizontal force are, like the absolute ranges, largest in magnitude, and that the most prominent features both of the declination and horizontal force curves (Figs. 378, 378*a*, 379 and 379*a*) are the oscillations with the sun-spot period of about eleven years, there being in each case three repetitions of a strongly marked upward inflection and a fourth similar inflection that is much less strongly developed, and in the one case two and in the other three strongly marked downward inflections. The maxima of declination range occur in 1848, in 1860 and about 1871·0 and the minima about 1856·0 and in 1866, and the later minimum and maximum are but indefinitely indicated: the maxima of horizontal force occur about 1849·0, about 1860·0 and in 1870 and the minima in 1855, in 1867 and in 1878, and the later maximum is again indefinitely indicated. The slight depression of the declination magnetograph curve below the magnetometer curve in 1871 and 1872 must be regarded either as an instrumental effect, or as a defect of the range in the underground magnetograph room as compared with its value above ground; and similarly with the more considerable defect, in 1872, the magnitude of which is between ·0007 and ·0008, of the range of the horizontal force magnetograph as compared with that of the magnetometer: it is because of the absence of strict comparability between the magnetometer series and the magnetograph series indicated by these differences, that in neither case has the process of reduction been allowed to run the two series into one another. When the three magnetograph curves (Figs. 378*a*, 379*a* and 380) are examined by themselves we still find the inflections of the sun-spot period the most marked feature of the horizontal force curve, but they have ceased to be predominant in the declination curve, and a most remarkable approximation to parallelism of movement shows itself in the declination and vertical force curves from the middle of 1874 to the middle of 1888, that is, through the whole period of the latter curve except the first year, and the ratio of the movements is, like the ratio of the absolute ranges, about as 3 of declination to 2 of vertical force; moreover the inflections of the two curves are such as to suggest that an element of the variation in the sun-spot period, that, namely, having for its period one-third of the sun-spot period, or about $3\frac{2}{3}$ years, has received special development since 1874. To find the average amount and character of this variation, and to test whether it is present in the preceding magnetometer variations, only masked in them by larger and more prominent variations, the following combinations were made.

70. The first thirty of the mean declination ranges in Table 62 were arranged in order forming a first line, the second thirty under these forming a second line and the third thirty under the last, in order, forming a third line: the means were then taken of the three sets of numbers in each vertical column, and the series of thirty such means were treated as representing, sufficiently nearly, the variation for one-third (the middle third) of the period of 90 eighths of a year, or one-third of $11\frac{1}{4}$ years. Similarly the

fourth thirty, fifth thirty and sixth thirty numbers of Table 62 were arranged in three lines to find the variation for the middle third of the second period of $11\frac{1}{4}$ years. The excess of each of the thirty means above the mean of them all is shown in Table 65, declination magnetometer, lines 1 and 2; and similar excesses are shown in lines 3 and 4 when the calculations embrace respectively the last but one set of ninety and the last set of ninety of the numbers of Table 62. In the same manner were found the excesses of Table 65, declination magnetograph, lines 1 and 2, and vertical force magnetograph, lines 1 and 2, there being in these cases only one period of $11\frac{1}{4}$ years reckoned onward from the beginning, and one period of $11\frac{1}{4}$ years reckoned backward from the end. And, except that the numbers of Table 63, of horizontal force ranges, were taken in sets of forty-four instead of thirty, the excesses of Table 65, horizontal force magnetometer and horizontal force magnetograph were obtained in the same manner as the excesses of declination—magnetometer and magnetograph: the period the variation of which is represented by the excesses is thus, in this case, one-third of 11 years instead of $11\frac{1}{4}$ years.

TABLE 65.—*Variations in a period of 3⅔ years of the diurnal range of Declination, Horizontal Force and Vertical Force.*

Period.	DECLINATION MAGNETOMETER.															Values of *m*
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1846·50 to 1857·62 ...	+·00019	+·00012	+·00007	—·00005	—·00005	—·00007	—·00012	—·00016	—·00016	—·00015	—·00018	—·00009	—·00001	+·00003	+·00007	See para. 71.
1857·75 to 1868·87 ...	−·00003	+·00004	+·00003	+·00005	+·00013	+·00003	—·00007	—·00015	—·00013	—·00015	—·00010	—·00006	—·00010	—·00002	·00000	
1850·12 to 1861·25 ...	+·00007	+·00003	—·00001	—·00002	—·00008	—·00003	—·00010	—·00011	—·00013	—·00012	—·00013	—·00010	—·00004	·00000	+·00004	
1861·37 to 1872·50 ...	−·00010	−·00015	—·00001	—·00004	—·00003	+·00003	—·00002	—·00008	—·00017	—·00018	—·00021	—·00013	—·00002	+·00006	+·00014	
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Table continued from above	+·00007	+·00010	+·00005	+·00007	+·00003	+·00002	—·00004	—·00005	+·00001	·00000	+·00007	+·00002	+·00007	+·00006	+·00014	+·00000294
	−·00001	—·00002	—·00003	—·00005	—·00007	+·00006	+·00002	+·00009	+·00012	+·00011	+·00011	+·00004	+·00004	—·00003	+·00001	+·00000270
	+·00006	·00000	+·00004	—·00003	·00000	—·00002	+·00006	+·00001	·00000	+·00010	+·00009	+·00015	+·00007	+·00010	+·00005	+·00000498
	+·00015	+·00017	+·00019	+·00019	+·00014	+·00004	+·00001	—·00001	+·00003	+·00008	+·00004	+·00002	—·00005	—·00001	—·00001	+·00000504
	DECLINATION MAGNETOGRAPH.															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1871·50 to 1882·62 ...	+·00010	+·00012	+·00013	+·00016	+·00011	+·00007	+·00009	+·00012	+·00011	+·00012	+·00012	+·00008	+·00008	+·00008	+·00008	
1877·37 to 1888·50 ...	+·00017	+·00019	+·00026	+·00030	+·00029	+·00025	+·00017	+·00004	—·00008	—·00014	—·00025	—·00037	—·00041	—·00034	—·00030	
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Table continued from above	+·00009	+·00013	+·00010	+·00010	+·00011	+·00013	+·00008	+·00002	—·00004	—·00015	—·00029	—·00035	—·00040	—·00047	—·00051	—·00001666
	—·00021	—·00013	—·00014	—·00005	+·00002	+·00007	+·00009	+·00009	+·00008	+·00003	+·00010	+·00010	+·00007	+·00007	+·00007	—·00000294
	HORIZONTAL FORCE MAGNETOMETER.															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1847·50 to 1858·42 ...	—·00024	—·00015	—·00019	—·00015	—·00003	—·00001	·00000	+·00001	+·00001	+·00001	+·00004	+·00002	+·00006	+·00002	+·00011	
1858·50 to 1869·42 ...	+·00011	+·00008	+·00012	+·00018	+·00027	+·00023	+·00021	+·00019	+·00018	+·00022	+·00016	+·00016	+·00012	+·00011	+·00009	
1850·58 to 1861·50 ...	—·00037	—·00037	—·00037	—·00036	—·00025	—·00024	—·00019	—·00021	—·00017	—·00025	—·00016	—·00004	·00000	+·00002	—·00001	
1861·58 to 1872·50 ...	—·00029	—·00028	—·00027	—·00027	—·00025	—·00024	—·00022	—·00021	—·00026	—·00021	—·00013	+·00002	+·00003	+·00002	+·00004	

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
	+ ·00011	+ ·00013	+ ·00020	+ ·00022	+ ·00022	+ ·00022	+ ·00019	+ ·00015	+ ·00015	+ ·00011	+ ·00009	+ ·00006	+ ·00005	+ ·00001	—·00008	
	+ ·00005	—·00004	+ ·00005	+ ·00004	+ ·00005	+ ·00007	—·00002	—·00004	—·00004	—·00007	—·00009	—·00007	—·00006	—·00003	—·00010	
	—·00001	—·00001	+ ·00002	+ ·00001	+ ·00007	+ ·00005	+ ·00006	+ ·00005	·00000	+ ·00005	+ ·00006	+ ·00012	+ ·00021	+ ·00017	+ ·00014	
Table continued from above	+ ·00008	+ ·00020	+ ·00024	+ ·00025	+ ·00023	+ ·00025	+ ·00028	+ ·00028	+ ·00023	+ ·00028	+ ·00027	+ ·00026	+ ·00020	+ ·00007	+ ·00003	
	30	31	32	33	34	35	36	37	38	39	40	41	42	43		
	—·00010	—·00013	—·00015	—·00012	—·00010	—·00008	—·00011	—·00011	—·00011	—·00011	—·00010	+ ·00001	+ ·00002	+ ·00007		—·00000064
	—·00005	—·00008	—·00014	—·00010	—·00011	—·00018	—·00020	—·00018	—·00017	—·00016	—·00016	—·00014	—·00013	—·00011		—·00000960
	+ ·00016	+ ·00014	+ ·00011	+ ·00018	+ ·00019	+ ·00024	+ ·00016	+ ·00017	+ ·00013	+ ·00006	+ ·00008	+ ·00007	+ ·00007	+ ·00007		+ ·00001128
	+ ·00006	+ ·00003	+ ·00006	+ ·00002	—·00001	—·00002	—·00005	—·00006	—·00010	—·00007	—·00004	—·00009	—·00014	—·00014		+ ·00000458

HORIZONTAL FORCE MAGNETOGRAPH.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1872·50 to 1883·42 ...	+ ·00041	+ ·00039	+ ·00035	+ ·00034	+ ·00036	+ ·00030	+ ·00029	+ ·00023	+ ·00020	+ ·00018	+ ·00017	+ ·00013	+ ·00008	+ ·00009	+ ·00010	
1877·58 to 1888·50 ...	+ ·00009	+ ·00008	+ ·00012	+ ·00013	+ ·00010	+ ·00009	+ ·00008	+ ·00011	+ ·00013	+ ·00007	+ ·00008	+ ·00003	—·00001	—·00005	—·00007	
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
	+ ·00008	+ ·00006	+ ·00003	+ ·00002	+ ·00003	+ ·00004	—·00002	—·00005	—·00004	—·00002	—·00004	—·00010	—·00010	—·00012	—·00015	
Table continued from above	—·00011	—·00011	—·00013	—·00016	—·00019	—·00023	—·00022	—·00027	—·00026	—·00022	—·00019	—·00015	—·00012	—·00010	—·00008	
	30	31	32	33	34	35	36	37	38	39	40	41	42	43		
	—·00015	—·00015	—·00019	—·00021	—·00020	—·00024	—·00026	—·00026	—·00027	—·00028	—·00028	—·00025	—·00024	—·00021		—·00001598
	—·00005	+ ·00002	+ ·00012	+ ·00017	+ ·00016	+ ·00014	+ ·00016	+ ·00017	+ ·00014	+ ·00011	+ ·00010	+ ·00013	+ ·00014	+ ·00014		+ ·00000116

VERTICAL FORCE MAGNETOGRAPH.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
1873·50 to 1884·62 ...	+ ·00009	+ ·00010	+ ·00008	+ ·00012	+ ·00012	+ ·00011	+ ·00011	+ ·00012	+ ·00008	+ ·00005	+ ·00001	—·00007	—·00012	—·00017	—·00016	
1877·37 to 1888·50 ...	+ ·00021	+ ·00017	+ ·00017	+ ·00015	+ ·00011	+ ·00009	+ ·00008	+ ·00003	+ ·00001	—·00002	—·00010	—·00017	—·00022	—·00017	—·00016	
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Table continued from above	—·00018	—·00018	—·00019	—·00020	—·00016	—·00014	—·00010	—·00008	—·00007	·00000	+ ·00003	+ ·00004	+ ·00019	+ ·00021	+ ·00023	—·00000158
	—·00016	—·00018	—·00015	—·00009	—·00005	—·00001	—·00002	—·00004	+ ·00001	+ ·00002	+ ·00007	+ ·00011	+ ·00012	+ ·00012	+ ·00013	—·00000204

71. On curving the excesses of Table 65 it was at once seen that in some of them there was a considerable amount of progressive change—progressive from beginning to end of the period—mixed up with the strictly periodical variation of the several ranges; and the curve Fig. 379 of horizontal force ranges may be pointed to as indicating by the gradual rise of the three maxima and the rise of the second above the first minimum the presence in the variation represented by it of such progressive change. It was resolved, therefore, to eliminate any progressive change that might be found in the series of excesses generally; and a measure of the rate of it was obtained by expressing the several values of the excesses by the formula $a = mx$, where a and x are corresponding values of the excess and of the number of it reckoned from the beginning of the series, and by calculating, by least squares, the value of m that the series yields: and then, reversing the process, the calculated values of mx were deducted from the respective excesses, to find the strictly periodical variation. It is in this way that the excesses of Table 66 have been deduced from those of Table 65.

TABLE 66.—*Variations in a period of 3⅔ years of the diurnal range of Declination, Horizontal Force, and Vertical Force corrected for progressive change.*

Period.	DECLINATION MAGNETOMETER.														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1846·50 to 1857·62	+·00023	+·00016	+·00011	−·00002	−·00002	−·00004	−·00010	−·00014	−·00014	−·00013	−·00017	−·00008	·00000	+·00003	+·00007
1857·75 to 1868·87	+·00001	+·00008	+·00006	+·00008	+·00016	+·00006	−·00005	−·00013	−·00011	−·00014	−·00009	−·00005	−·00009	−·00002	·00000
1850·12 to 1861·25	+·00014	+·00010	+·00005	+·00004	−·00003	+·00002	−·00006	−·00007	−·00010	−·00009	−·00011	−·00008	−·00003	+·00001	+·00001
1861·37 to 1872·50	−·00003	−·00008	+·00005	+·00002	+·00002	+·00008	+·00002	−·00004	−·00014	−·00015	−·00019	−·00011	−·00001	+·00007	+·00014
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Table continued from above ...	+·00007	+·00010	+·00004	+·00006	+·00002	·00000	−·00006	−·00007	−·00001	−·00003	+·00004	−·00001	+·00003	+·00002	+·00010
	−·00001	−·00002	−·00004	−·00006	−·00008	+·00005	·00000	+·00007	+·00010	+·00008	+·00008	+·00001	+·00001	−·00007	−·00003
	+·00006	−·00001	+·00003	−·00005	−·00002	−·00005	+·00003	−·00003	−·00004	+·00005	+·00004	+·00009	+·00001	+·00003	−·00002
	+·00015	+·00016	+·00018	+·00017	+·00012	+·00001	−·00002	−·00005	−·00001	+·00003	−·00001	−·00004	−·00011	−·00008	−·00008
	DECLINATION MAGNETOGRAPH.														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1871·50 to 1882·62	−·00014	−·00010	−·00008	−·00003	−·00006	−·00009	−·00005	·00000	·00000	+·00003	+·00005	+·00002	+·00004	+·00006	+·00007
1877 37 to 1888·50	+·00013	+·00015	+·00022	+·00027	+·00026	+·00022	+·00015	+·00002	−·00010	−·00016	−·00026	−·00038	−·00042	−·00034	−·00030
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Table continued from above. ...	+·00010	+·00015	+·00014	+·00016	+·00018	+·00022	+·00019	+·00014	+·00010	+·00001	−·00012	−·00016	−·00019	−·00025	−·00027
	−·00021	−·00013	−·00013	−·00004	+·00003	+·00009	+·00011	+·00011	+·00010	+·00006	+·00013	+·00013	+·00011	+·00011	+·00011

HORIZONTAL FORCE MAGNETOMETER.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1847·50 to 1858·42	− ·00025	− ·00016	− ·00020	− ·00016	− ·00004	− ·00002	− ·00001	·00000	·00000	·00000	+ ·00003	+ ·00001	+ ·00005	+ ·00001	+ ·00011
1858·50 to 1869·42	− ·00010	− ·00012	− ·00007	·00000	+ ·00010	+ ·00007	+ ·00006	+ ·00005	+ ·00005	+ ·00010	+ ·00005	+ ·00006	+ ·00003	+ ·00003	+ ·00002
1850·58 to 1861·50	− ·00013	− ·00014	− ·00015	− ·00015	− ·00005	− ·00005	− ·00002	− ·00005	− ·00002	− ·00006	− ·00003	+ ·00008	+ ·00011	+ ·00012	+ ·00007
1861·58 to 1872·50	− ·00019	− ·00019	− ·00018	− ·00019	− ·00017	− ·00016	− ·00015	− ·00014	− ·00020	− ·00015	− ·00008	+ ·00007	+ ·00007	+ ·00006	+ ·00007
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	+ ·00011	+ ·00013	+ ·00020	+ ·00022	+ ·00022	+ ·00022	+ ·00019	+ ·00015	+ ·00015	+ ·00011	+ ·00009	+ ·00006	+ ·00005	+ ·00001	− ·00008
	− ·00001	− ·00009	+ ·00001	+ ·00001	+ ·00003	+ ·00006	− ·00002	− ·00004	− ·00003	− ·00005	− ·00006	− ·00003	− ·00001	+ ·00003	− ·00003
	+ ·00006	+ ·00005	+ ·00007	+ ·00005	+ ·00010	+ ·00007	+ ·00007	+ ·00004	− ·00002	+ ·00002	+ ·00002	+ ·00007	+ ·00015	+ ·00010	+ ·00006
	+ ·00011	+ ·00023	+ ·00026	+ ·00027	+ ·00024	+ ·00026	+ ·00028	+ ·00028	+ ·00022	+ ·00027	+ ·00025	+ ·00024	+ ·00017	+ ·00004	·00000
Table continued from above ...	30	31	32	33	34	35	36	37	38	39	40	41	42	43	
	− ·00009	− ·00012	− ·00014	− ·00011	− ·00009	− ·00007	− ·00010	− ·00010	− ·00010	− ·00010	− ·00009	+ ·00002	+ ·00003	+ ·00008	
	+ ·00003	+ ·00001	− ·00004	+ ·00001	+ ·00001	− ·00005	− ·00006	− ·00003	− ·00001	+ ·00001	+ ·00002	+ ·00005	+ ·00007	+ ·00010	
	+ ·00006	+ ·00003	− ·00001	+ ·00005	+ ·00005	+ ·00009	·00000	·00000	− ·00006	− ·00014	− ·00013	− ·00015	− ·00016	− ·00017	
	+ ·00002	− ·00001	+ ·00001	− ·00003	− ·00007	− ·00008	− ·00012	− ·00013	− ·00018	− ·00015	− ·00012	− ·00018	− ·00023	− ·00024	

HORIZONTAL FORCE MAGNETOGRAPH.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1872·50 to 1883·42	+ ·00007	+ ·00006	+ ·00004	+ ·00004	+ ·00008	+ ·00004	+ ·00004	·00000	− ·00003	− ·00002	− ·00001	− ·00004	− ·00007	− ·00005	− ·00002
1877·58 to 1888·50	+ ·00011	+ ·00010	+ ·00014	+ ·00015	+ ·00012	+ ·00011	+ ·00010	+ ·00013	+ ·00015	+ ·00008	+ ·00009	+ ·00004	·00000	− ·00004	− ·00006
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	− ·00002	− ·00003	− ·00004	− ·00004	− ·00001	+ ·00002	− ·00003	− ·00004	− ·00002	+ ·00002	+ ·00002	− ·00003	− ·00001	− ·00002	− ·00003
	− ·00010	− ·00010	− ·00012	− ·00016	− ·00019	− ·00023	− ·00022	− ·00027	− ·00026	− ·00022	− ·00019	− ·00016	− ·00013	− ·00011	− ·00009
Table continued from above ...	30	31	32	33	34	35	36	37	38	39	40	41	42	43	
	− ·00001	·00000	− ·00002	− ·00003	·00000	− ·00002	− ·00003	− ·00001	− ·00001	·00000	+ ·00002	+ ·00006	+ ·00009	+ ·00013	
	− ·00006	+ ·00001	+ ·00011	+ ·00016	+ ·00015	+ ·00012	+ ·00014	+ ·00015	+ ·00012	+ ·00009	+ ·00008	+ ·00011	+ ·00012	+ ·00012	

VERTICAL FORCE MAGNETOGRAPH.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1873·50 to 1584·62	+ ·00007	+ ·00008	+ ·00006	+ ·00010	+ ·00010	+ ·00009	+ ·00010	+ ·00011	+ ·00007	+ ·00004	·00000	− ·00008	− ·00012	− ·00017	− ·00016
1877·37 to 1888·50	+ ·00018	+ ·00014	+ ·00014	+ ·00013	+ ·00009	+ ·00007	+ ·00006	+ ·00001	·00000	− ·00003	− ·00011	− ·00018	− ·00023	− ·00017	− ·00016
	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Table continued from above ...	− ·00018	− ·00018	− ·00019	− ·00019	− ·00015	− ·00013	− ·00009	− ·00007	− ·00006	+ ·00002	+ ·00005	+ ·00016	+ ·00021	+ ·00023	+ ·00025
	− ·00016	− ·00018	− ·00014	− ·00008	− ·00004	·00000	− ·00001	− ·00002	+ ·00003	+ ·00004	+ ·00009	+ ·00013	+ ·00015	+ ·00015	+ ·00016

It is not meant hereby that a periodical variation cannot have in it a gradual progressive movement from end to end and then a sudden recovery, but that it is more interesting, even in that case, to consider the progressive movement and the rest of the periodical variation separately, and the latter is, in any case, worth consideration apart from the former. The excesses of Table 66 are curved in Plate VII forming Figs. 381 to 394 respectively; and, taking the period as exactly $3\frac{2}{3}$ years, identical phases are marked by vertical arrows on the declination, horizontal force, and vertical force range curves separately.

72. In the horizontal force curves it will be noticed that the arrows at 1853·83, 1868·50 and 1883·17 are at corresponding positions after similar movements of considerable range, whilst the intermediate curves (Figs. 388 to 391) show but little character or range; hence it would appear that the variation is subject to growth and decay, its times of maximum development occurring at intervals of $14\frac{2}{3}$ years. Similarly, noticing the declination arrows at 1853·25, 1867·92 and 1882·59, and the parts of the curves preceding them, the same may be said of the variation of range of this element, but with the additional remark that the variation of the last period is relatively more developed than in the case of the horizontal force, and that it differs but little from that of the next preceding period extending from 1875 to 1878. The variation is also definitely shown by the two curves of vertical force range (Figs. 393 and 394), but it is of less range than the declination variation of the same epoch. It may be mentioned here that the period of $14\frac{2}{3}$ years is about half the period of revolution of the planet Saturn.

73. In the same way that the annual variation of the diurnal range has been eliminated in Tables 62 to 64, it was considered desirable to eliminate further the variation of eleven-year period; and this was done by taking the mean of the first and eighty-eight following numbers of Table 62 and entering it as the first number of Table 67, the mean of the second and eighty-eight following numbers and entering it as the second number of Table 67, and so on; and similarly Table 69 was formed from Table 64. In forming the numbers of Table 68 from those of Table 63, the means were taken of the first and one hundred and thirty-two following numbers, &c., &c. The numbers of Tables 67 to 69 are curved in Plate VII forming Figs. 395, 395*a*, 396, 396*a* and 397. The most remarkable feature displayed by the curves is the nearly uniform secular increase of horizontal force range from 1853 to 1861.

TABLE 67.—*Secular variation of the diurnal range of Declination after eliminating variations in a period of about 11 years.*

DECLINATION MAGNETOMETER.								
Year.	Eighths of a year.							
	0	1	2	3	4	5	6	7
1852	·00465	·00464	·00464	·00464	·00464	·00464	·00464	·00464
1853	·00464	·00465	·00465	·00465	·00466	·00466	·00466	·00466
1854	·00466	·00466	·00466	·00466	·00466	·00466	00·467	·00467
1855	·00468	·00468	·00469	·00469	·00470	·00470	·00470	·00471
1856	·00471	·00471	·00472	·00472	·00472	·00473	·00473	·00474
1857	·00474	·00474	·00474	·00475	·00475	·00475	·00475	·00474
1858	·00474	·00474	·00474	·00474	·00474	·00474	·00474	·00473
1859	·00473	·00473	·00472	·00472	·00471	·00471	·00471	·00471
1860	·00471	·00471	·00471	·00471	·00471	·00470	·00470	·00470
1861	·00469	·00469	·00468	·00468	·00468	·00468	·00468	·00468
1862	·00468	·00468	·00468	·00468	·00468	·00468	·00469	·00469
1863	·00469	·00469	·00469	·00469	·00469	·00469	·00469	·00469
1864	·00469	·00469	·00469	·00469	·00469	·00469	·00470	·00470
1865	·00471	·00472	·00473	·00474	·00475	·00476	·00477	·00477
1866	·00478	·00478	·00478	·00478	·00479	·00479	·00479	·00479
1867	·00480							

TABLE 67—*continued.*

Year.	Eighths of a year.							
	0	1	2	3	4	5	6	7
DECLINATION MAGNETOGRAPH.								
1877	·00428	·00426	·00424	·00422	·00420	·00419	·00417	·00416
1878	·00415	·00414	·00413	·00413	·00412	·00411	·00411	·00411
1879	·00411	·00411	·00411	·00411	·00411	·00412	·00412	·00413
1880	·00414	·00414	·00415	·00415	·00416	·00416	·00416	·00416
1881	·00417	·00417	·00418	·00418	·00418	·00419	·00420	·00420
1882	·00421	·00421	·00421	·00422	00·422	·00422	·00422	·00421
1883	·00421							

TABLE 68.—*Secular variation of the diurnal range of Horizontal Force after eliminating variations in a period of about 11 years.*

Year.	Twelfths of a year.											
	0	1	2	3	4	5	6	7	8	9	10	11
HORIZONTAL FORCE MAGNETOMETER.												
1853 ...	·00596	·00597	·00598	·00598	·00599	·00600	·00600	·00601	·00602	·00602	·00603	·00603
1854 ...	·00604	·00605	·00605	·00606	·00606	·00606	·00606	·00607	·00607	·00608	·00608	·00609
1855 ...	·00609	·00610	·00611	·00611	·00612	·00613	·00615	·00616	·00617	·00618	·00619	·00620
1856 ...	·00621	·00622	·00623	·00623	·00624	·00625	·00626	·00626	·00627	·00627	·00628	·00628
1857 ...	·00629	·00629	·00630	·00630	·00630	·00631	·00632	·00632	·00632	·00633	·00633	·00633
1858 ...	·00634	·00634	·00635	·00635	·00635	·00635	·00636	·00636	·00636	·00636	·00636	·00636
1859 ...	·00637	·00637	·00637	·00637	·00637	·00637	·00638	·00638	·00638	·00638	·00639	·00639
1860 ...	·00640	·00640	·00640	·00641	·00642	·00642	·00643	·00643	·00644	·00644	·00645	·00645
1861 ...	·00646	·00646	·00646	·00646	·00647	·00647	·00647	·00647	·00647	·00647	·00647	·00647
1862 ...	·00647	·00647	·00646	·00646	·00646	·00646	·00646	·00645	·00645	·00645	·00645	·00644
1863 ...	·00644	·00644	·00644	·00643	·00643	·00642	·00642	·00642	·00641	·00641	·00640	·00640
1864 ...	·00640	·00639	·00639	·00638	·00638	·00638	·00638	·00638	·00638	·00638	·00639	·00639
1865 ...	·00640	·00640	·00641	·00642	·00642	·00643	·00644	·00645	·00645	·00646	·00646	·00647
1866 ...	·00647	·00647	·00648	·00648	·00649	·00649	·00649	·00649	·00650	·00650	·00650	·00650
1867 ...	·00651											
HORIZONTAL FORCE MAGNETOGRAPH.												
1878 ...	·00458	·00456	·00455	·00454	·00453	·00452	·00451	·00451	·00450	·00450	·00449	·00449
1879 ...	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448
1880 ...	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448	·00448
1881 ...	·00448	·00448	·00448	·00447	·00447	·00447	·00447	·00447	·00447	·00447	·00447	·00447
1882 ...	·00447	·00447	·00447	·00447	·00447	·00447	·00448	·00448	·00448	·00448	·00448	·00448
1883 ...	·00448											

TABLE 69.—*Secular variation of the diurnal range of Vertical Force after eliminating variations in a period of about 11 years.*

Year.	Eighths of a year.							
	0	1	2	3	4	5	6	7
VERTICAL FORCE MAGNETOGRAPH.								
1879	·00264	·00265	·00266	·00266	·00266	·00267	·00267	·00267
1880	·00267	·00267	·00267	·00267	·00267	·00267	·00267	·00267
1881	·00267	·00267	·00267	·00268	·00268	·00268	·00268	·00269
1882	·00269	·00269	·00269	·00269	·00269	·00269	·00269	·00268
1883	·00268							

74. *Mean readings of the thermometers enclosed with the horizontal force and vertical force magnetographs.*—These means, for each month of the year, are derived from observations taken between January 1878 and December 1888 at the hours 6, 10, 14, 16 and 22: and they are accompanied, in the following table, by the inequalities at each of the five hours as compared with the mean of all.

TABLE 70.

Month.	Thermometer of Horizontal Force Magnetograph. Inequalities. Hour. 6	10	14	16	22	Range.	Mean of five hours.	Thermometer of Vertical Force Magnetograph. Inequalities. Hour. 6	10	14	16	22	Range.	Mean of five hours.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January ...	+·01	+·09	−·01	−·04	−·04	0·13	86·80	·00	+·08	−·02	−·04	−·04	0·12	86·24
February ...	+·04	+·10	−·03	−·07	−·04	·17	86·28	+·02	+·11	−·02	−·05	−·04	·16	85·79
March ...	+·06	+·11	−·04	−·09	−·04	·20	87·39	+·04	+·11	−·04	−·08	−·04	·19	86·91
April ...	+·06	+·09	−·03	−·07	−·05	·16	89·45	+·03	+·09	−·03	−·06	−·04	·15	89·01
May ...	+·01	+·03	−·02	−·02	−·02	·05	91·72	+·01	+·03	−·01	−·02	+·01	·05	91·33
June ...	+·01	+·03	−·01	−·01	−·02	·05	92·60	·00	+·03	−·01	−·01	−·02	·05	92·13
July ...	−·01	+·03	+·01	+·01	−·01	·04	91·09	+·01	+·04	−·01	−·01	−·03	·07	90·61
August ...	·00	+·03	−·01	−·01	−·02	·05	90·20	+·01	+·03	−·01	−·02	−·01	·05	89·65
September .	+·04	+·05	−·02	−·03	−·02	·08	89·78	+·03	+·05	−·02	−·03	−·02	·08	89·26
October ...	+·05	+·07	−·02	−·06	−·05	·13	89·66	+·04	+·07	−·01	−·04	−·04	·11	89·19
November .	+·05	+·07	·00	−·04	−·07	·14	89·18	+·04	+·07	−·01	−·05	−·07	·14	88·67
December .	+·01	+·07	·00	−·05	−·05	·12	87·85	·00	+·06	·00	−·04	−·04	·10	87·32
Year ...	+·03	+·06	−·01	−·04	−·04	...	...	+·02	+·06	−·02	−·04	−·03	...	...

75. In no month is the daily range, between any of the five hours, greater than 0°·20 for the horizontal force thermometer or 0°·19 for the vertical force thermometer; and during the monsoon months the respective average ranges are only 0°·05 and 0°·06. The effect of ignoring these small quantities, as affecting the deduced diurnal variations of horizontal force, is quite insignificant. It is small, too, as affecting the diurnal variation of vertical force, but not insignificant.

The inequalities for each hour in each year are shown in Table 71, as are also the averages for the five hours in each year.

TABLE 71.

Year.	Thermometer of Horizontal Force Magnetograph. Inequalities. Hour. 8	10	12	14	16	Range.	Mean of five hours.	Thermometer of Vertical Force Magnetograph. Inequalities. Hour. 6	10	14	16	22	Range.	Mean of five hours.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1871* ...	−·07	−·03	+·01	+·06	+·03	0·13	90·20							
	Hour. 6	10	14	16										
1872 ...	−·06	·00	+·05	·00		·11	90·97							
	Hour. 6	10	14	16	22									
1873 ...	+·04	·00	−·01	−·04	+·01	·08	90·20	+·03	+·01	·00	−·04	+·01	0·07	88·64
1874 ...	−·10	+·03	+·05	+·05	−·03	·15	87·89	−·09	+·02	+·05	+·04	−·02	·14	86·68
1875† ...								−·07	+·07	+·05	·00	−·03	·14	88·79
1876 ...								−·06	+·14	−·01	−·06	−·04	·20	89·41
1877 ...								−·06	+·11	·00	−·04	−·03	·17	90·86
1878 ...	−·02	+·04	−·01	−·04	+·02	·08	91·06	−·04	+·06	+·01	−·02	−·01	·10	90·28
1879 ...	−·02	+·06	+·01	−·02	−·02	·08	89·78	−·03	+·07	+·01	−·02	−·01	·10	89·18
1880 ...	−·01	+·04	·00	−·03	·00	·07	87·99	−·04	+·05	+·01	−·02	·00	·09	87·54
1881 ...	+·02	+·07	−·02	−·05	−·05	·12	88·90	+·02	+·07	−·02	−·03	−·03	·10	88·15
1882‡ ...	+·20	+·07	−·07	−·10	−·10	·30	89·00	+·20	+·05	−·07	−·10	−·09	·30	88·16
1883‡ ...	+·14	+·05	−·03	−·06	−·10	·24	88·85	+·14	+·05	−·03	−·06	−·09	·23	88·56
1884 ...	−·01	+·08	·00	−·02	−·04	·12	87·76	−·01	+·08	−·01	−·02	−·03	·11	87·93
1885 ...	+·03	+·10	−·03	−·06	−·04	·16	89·63	+·01	+·10	−·03	−·06	−·03	·16	89·43
1886 ...	·00	+·08	−·01	−·03	−·03	·11	89·63	−·02	+·08	−·01	−·02	−·02	·10	89·17
1887 ...	−·01	+·04	·00	−·03	−·02	·07	89·18	·00	+·06	−·01	−·03	−·01	·09	88·58
1888 ...	+·01	+·06	−·01	−·02	−·02	·08	90·88	·00	+·06	−·01	−·02	−·01	·08	90·27

* The inequalities for the years 1871 and 1872 are derived from readings taken on all days except Sundays and holidays, but those for 1873 and later years are derived from readings taken on all days without exception.

† On the 9th March 1875 the ivory scale of the horizontal force thermometer cracked by reason of long exposure to the attenuated dry air of the enclosure, and the thermometer, falling down, was no more read till the enclosure was next opened in February 1877.

‡ From September 1881 to November 1883 ventilation of the magnetograph room was allowed to proceed at night through the apparatus box only, the object being to keep the sensitive papers surrounded by fresh air, and the usual ventilating inlet on the north side of the room was opened only during the day: it was found, however, that the diurnal range of the temperature of the room was thereby sensibly increased, and the former practice of leaving the ventilator open night and day was reverted to on the 30th November 1883.

76. *Rules observed in the treatment of imperfect magnetograms.*—When for any reason the photographic traces furnished by the magnetographs are interrupted, and the interruption includes the moments when one or more hourly tabulations should be made, these last are either substituted by the corresponding eye-observations, if the hours should happen to be any of the five regular observation hours, or if special eye-observations were taken for the purpose, or else, if no eye-observations are available, they are interpolated. In the last case, if the interruption lasts for less time than one hour, the interpolation is made on the assumption that the rate of change of the phenomenon from its value at the beginning to its value at the end of the interruption was uniform, providing that the parts of the curve immediately preceding and immediately following the gap were, in appearance, continuations of the straight line connecting the extremities of the gap. If the last condition is not satisfied, or if the gap, taking account of points inserted by means of eye-observations, is of greater length than one hour, the interpolation is made between the next preceding and the next following hourly entries, first, by allowing for the known *normal* rate of change of the phenomenon between those hours in the same month, and then by assuming that any additional change, shown by the difference between the values of the phenomenon at the two extreme hours, has grown at a uniform rate. Interpolated values are entered in the abstract sheets with enclosing square brackets—inserted eye-observations between parentheses. In statements that follow each case of interruption is marked by a number signifying that the interpolation or substitution has been made by one of four rules, *viz.*, [1] by interpolation as first described above, [2] by interpolation as last described above when no modified eye-observations are inserted, [3] the same when one or more modified eye-observations are inserted, and [4] by the insertion of equivalents of the readings of the old magnetometers after reduction of these to the proper minute of the missing tabulations. Hours for which eye-observations of the identical instrument were available are marked within parentheses.

In tabulating the magnetograms no regard is paid to events that have been noted as possible disturbances of the record—such as the occasional use of tools in the magnetograph room, bringing near of a small magnet in the course of deflection experiments made upon either of the two other instruments, the approach of vehicles or other large bodies containing iron in their structure, or oscillation of the declination and horizontal force magnets caused by rapid artificial cooling of the magnetograph room, unless they cause evident and irregular (and therefore ineradicable) disruptions of the curve, and in this case the disturbed part of the curve is rejected and treated as an interruption. Also in tabulating curves that exhibit experimental deflections made upon the instrument itself, the deflections are treated as interruptions, except in cases in which the deflector magnet was away at the minute of tabulation, and—if a vertical force tabulation—the curve had apparently returned to its normal position. In the declination and horizontal force magnetograms, and sometimes in those of the vertical force, dislocations generally come in pairs, of equal and opposite amount, the one on the introduction and the other on the removal of a cause of disturbance, and in these cases the disturbance is measured and eliminated during the interval of its action: but accidental disturbances occur in the vertical force magnetograms that are not afterwards reversed, and for these the lesser portion of the day's curve is corrected so as to make the whole day comparable, but no attempt is made to restore the comparability from day to day that may be supposed to have existed before the disturbance occurred. If the curve is lost for the proper moment of tabulation, but is available for a minute before or a minute after, the tabulation is made for the adjacent minute and is adopted as that of the proper moment. When one edge of the curve is interrupted by an air bubble, photographic stain or other cause, whilst the other edge is legible, allowance is made, in tabulating, for the full breadth of the curve just before and just after the interruption. It should have been mentioned before that the magnetographs, like the Colába barograph and thermograph (*see* Magnetical and Meteorological Observations, 1871 to 1878, Introduction, page xx), are provided with automatic shutters which close at two minutes before and open two minutes after each even hour, thus cutting off the light for four minutes and dividing the magnetic curves and their datum lines into two-hour sections; the clockwork is well made, so that the occurrence of the interruptions is never more than a minute in error; and care is taken to keep the rate of the clock small, and to set the clock accurately every day, and with these precautions it is considered allowable to regard the two-hour breaks in the curves as marking accurately the even hours of the day, though they are always tested, by seeing that the first and last breaks agree with the times of starting and stopping the clock, before the commencement of a day's tabulations.

The time-lines on the index glasses of the tabulator are at 0^m, 17^m and 19^m, the first of which is set on the two-hourly break, whilst the others and the space midway between them mark the minutes 17, 18 and 19 for which tabulations of the several curves have to be made; the tabulations for the odd hours are obtained by moving forward the T frame by the space of one hour upon its accurately divided time-scale,—a movement that is effected with great facility by means of hourly notches cut on the edge of the scale.

When portions of a day's datum line aggregating less than twelve hours have been lost or been too faint for tabulation, they have been substituted by imaginary straight lines connecting or continuing the portions of the remaining twelve or more hours of the datum. If one of the two datum lines on a curve sheet be complete or be completed as first described, and the other is missing through a greater aggregate than twelve hours, the relation between the two is obtained by measurement at a number of corresponding points, and the mean difference between them is applied as a correction to tabulations made from the complete datum line of the other day's curve.

77. *Calculation of diurnal variation for a month of broken periods.*—When the record is interrupted once or oftener in the course of a month, by fresh adjustment, heating experiments, or any other cause, the tabulations of each uninterrupted period are treated separately to obtain the diurnal variation for that period expressed first in tabulations, then corrected for progressive change of tabulation, and then converted into force; and finally the mean diurnal variation for the month is obtained from those of the subordinate periods, giving weight to these in proportion to the number of days which they severally comprise.

78. *Calculations carried to how many places of decimals.*—Hourly means and variations of tabulations have been calculated to four places of decimals, and not, as before, to three places only, *viz*:

for the declination magnetograph since May 1882,
for the horizontal force magnetograph since May 1880,
and for the vertical force magnetograph since May 1879.

And monthly means of the readings, at the five observation hours, of the thermometers of the horizontal force and vertical force magnetographs have been calculated since May 1884 to two places of decimals, and not, as before that month, to one place only.

79. *Statement of irregularities of procedure.*—The following statement shows all the irregularities of procedure that have been rendered necessary by extraneous disturbing influences or by imperfections in the working or management of the instruments.

Declination Magnetograph.

80. *Curve affected and corrections applied to tabulations.*

1886, January 16.—Iron rails and two 38-ton guns with their carriages were carried along the main road towards the Colába Point Battery; dislocation of +·077 allowed for 7^h and of +·005 for 8^h.

1886, February 1.—Vertical force magnet taken out of room at 12^h; dislocation of —·025 was allowed for.

1887, January 31.—Vertical force magnet taken out of room at 14^h and 15^h; dislocation of —·022 was allowed for.

81. *Entries in abstracts obtained by interpolation or by substitution of eye-observations—not by direct tabulation.*

Rule of interpolation, &c.

(1) Clock being cleaned or taken to pieces:

for 1882 July 27^d 10^h to 18^h: 1883 December 9^d 16^h: and 1887 December 1^d 10^h to 16^h [3]

(2) Owing to stoppage of clock:

for 1883 December 11^d 9^h and 17^d 9^h: and 1884 April 3^d 9^h. [1]
for 1883 December 9^d 12^h and 13^h [2]
for 1884 July 26^d 22^h [3]

Rule of interpolation, &c.

(3) Central rod of vertical force cylinder screwed tight in its bed:
for 1884 February 1d 10h [3]

(4) Clock stopped—owing to breakage of the suspension cord of the driving weight:
for 1887 May 31d 3h [2]
for 1884 July 22d 10h [3]

(5) Owing to vibration and dislocations produced when deflection experiments on vertical force magnetograph were going on:
for 1885 March 6d 20h [1]

(6) Iron rails and two empty carriages of the two 38-ton guns were carried back from the Colába Point Battery:
for 1886 January 21d 8h [2]

Occasional, though rare, failure of the bi-hourly stops to act has caused no loss of record.

Horizontal Force Magnetograph.

82. *List of days the curves of which were rejected.*

1881, January 8 and 9.—Heating experiments going on in the magnetograph room; effect of temperature changes variable and uncertain.

1881, February 24 and 25.—Heating experiments going on in the magnetograph room; effect of temperature changes variable and uncertain.

83. *Curve affected and corrections applied to tabulations.*

1880, July 27d 11h to August 1d 9h.—Enclosure was exhausted on 27th; causing a permanent change in the set of the instrument; this was detected by comparison with the readings of Grubb's horizontal force magnetometer: change of —·031 allowed for from July 27d 14h to August 1d 9h to make the tabulations comparable with those of the 1st to 27th July. From July 27d 11h to 13h, the curve being lost, the entries in the abstract were obtained by interpolation.

1881, January 11.—Vertical force magnet taken out of room at 12h; dislocation of —·017 was allowed for.

1882, June 30d 11h to July 1d 9h.—Instrument was being re-adjusted: change of ordinate and change of scale coefficient allowed for from June 30d 17h to July 1d 7h and for July 1d 9h, giving for the respective corrected ordinates 0·891; 0·886; 0·884; 0·880; 0·888; 0·880; 0·878; 0·882; 0·886; 0·885; 0·887; 0·887; 0·886; 0·890; 0·908 and 0·913. From June 30d 11h to 16h and July 1d 8h, the curve being lost, the entries in the abstract were obtained by interpolation.

1884, December 31d 12h to 1885, January 1d 9h.—Instrument was under adjustment: change of ordinate and change of scale coefficient allowed for from 1884 December 31d 20h to 1885, January 1d 8h, giving for the respective corrected ordinates 0·407; 0·376; 0·305; 0·326; 0·338; 0·333; 0·333; 0·307; 0·382; 0·406; 0·469; 0·554 and 0·619. From December 31d 12h to 19h, the curve being lost, equivalents of the eye-observations of Grubb's horizontal force magnetometer were substituted for the missing tabulations. For 1885, January 1d 9h, the curve having gone out of the field, the entry in the abstract was obtained by interpolation.

1885, January 1d 10h to 5d 13h.—Instrument was under adjustment on several occasions: change of ordinate and change of scale coefficient allowed for for 1d 10h and 11h; from 1d 22h to 3d 12h; and from 3d 22h to 5d 11h, giving for the respective corrected ordinates 3·982; 3·960; 3·733; 3·773; 3·770; 3·771; 3·779; 3·828; 3·827; 3·858; 3·907; 4·004; 4·121; 4·132; 4·169; 4·051; 3·887; 3·852; 3·733; 3·619; 3·203; 3·330; 3·052; 2·962; 3·328; 3·530; 3·460; 3·463; 3·382; 3·278; 3·426; 3·460; 3·565; 3·544; 3·580; 3·640; 3·767; 3·757; 3·797; 3·797; 3·737; 3·590; 3·621; 3·589; 3·584; 3·613; 3·619; 3·630; 3·632; 3·692; 3·726; 3·792; 3·875; 3·945; 3·947; 3·971; 3·947; 3·798; 3·707; 3·642; 3·565; 3·599; 3·551; 3·612; 3·629; 3·617; 3·645; 3·645; 3·666; 3·653; 3·663; 3·670; 3·675; 3·700; 3·754; 3·797; 3·887; 3·993; and 3·977.

From $1^d\ 12^h$ to 21^h, $3^d\ 13^h$ to 21^h and $5^d\ 13^h$, the curve being lost, equivalents of the eye-observations of Grubb's horizontal force magnetometer were substituted for the missing tabulations.

1885, April $29^d\ 17^h$ to $30^d\ 6^h$.—Lowered curve to prevent it from encroaching on the previous day's curve, when the datum line went out of the field. During the interval the tabulation was made with previous day's datum line, and a correction of +1·232 was applied to the tabulated numbers.

1886, January $16^d\ 7^h$ to $18^d\ 5^h$.—Iron rails and two 38-ton guns with their carriages were carried along the main road towards the Colába Point Battery; dislocations allowed for—of +·013 for $16^d\ 7^h$, of —·145 for $16^d\ 8^h$ and of —·032 from $16^d\ 9^h$ to $18^d\ 5^h$.

1886, January $30^d\ 10^h$ to February $1^d\ 9^h$.—Heating experiments were going on in the magnetograph room: corrections due to varying temperatures allowed for at the rate of ·0255 inch *per* degree.

1886, February 1.—Vertical force magnet taken out of room at 12^h; dislocation of —·039 was allowed for.

1887, January 31.—Vertical force magnet taken out of room at 14^h and 15^h; dislocation of —·046 was allowed for.

1888, January $18^d\ 10^h$ to $20^d\ 9^h$.—Heating experiments were going on in the magnetograph room: corrections due to varying temperatures allowed for at the rate of ·0254 inch *per* degree.

1888, June $1^d\ 10^h$ to 19^h.—Alteration of distance apart of the wires at top: change allowed for of +3·343 for 10^h and 11^h. From 12^h to 19^h, curve being lost, equivalents of the eye-observations—of those of Grubb's horizontal force magnetometer from 12^h to 16^h and of those of the horizontal force magnetograph from 17^h to 19^h—were substituted for the missing tabulations.

84. *Entries in abstracts obtained by interpolation or by substitution of eye-observations —not by direct tabulation.*

		Rule of interpolation, &c.
(1)	Owing to failure of light:	
	for 1882 May $23^d\ 21^h$	[1]
	for 1880 November $20^d\ 18^h$ and 19^h: and 1881 April $25^d\ 7^h$ ...	[2]
	for 1880 June $25^d\ 6^h$	[3]
(2)	Curve too faint to tabulate:	
	for 1880 August $5^d\ 14^h$	[3]
(3)	Clock stopped—owing to the breakage of the suspension cord of the driving weight:	
	for 1881, November $13^d\ 9^h$: and 1887, May $31^d\ 3^h$	[2]
	for 1881, September $11^d\ 6^h$: and 1884, July $22^d\ 10^h$	[3]
(4)	Owing to stoppage of clock:	
	for 1883, December $11^d\ 9^h$: and 1884, April $3^d\ 9^h$	[1]
	for 1882, January $19^d\ 8^h$: and 1883, December $9^d\ 12^h$ and 13^h ...	[2]
	for 1884, July $26^d\ 22^h$	[3]
(5)	Preparation for re-adjustment of the instrument, and to pump the air out of the enclosure:	
	for 1882, June $29^d\ 11^h$ to 17^h	[2]
(6)	Vibration caused by agitation of air in the enclosure after exhaustion:	
	for 1882, July $5^d\ 12^h$ and 13^h	[2]
(7)	Deflection experiments going on:	
	for 1882, July $12^d\ 23^h$; 1883, August $13^d\ 21^h$ to 23^h; and 1884, September $22^d\ 23^h$; and December $22^d\ 23^h$	[1]
	for 1886, February $24^d\ 21^h$ to 23^h	[4]

Rule of interpolation, &c.

(8) Clock being cleaned or taken to pieces:
for 1882, July 27^d 10^h to 18^h: 1883, December 9^d 16^h: and 1887, December 1^d 10^h to 16^h ... ... [3]

(9) Curve obliterated by photographic stain:
for 1882, August 6^d 20^h: and 1886, September 6^d 18^h ... [1]

(10) Central rod of vertical force cylinder screwed tight in its bed:
for 1884, February 1^d 10^h ... ... [3]

(11) Deflector magnet brought near the instrument for some experiment:
for 1884, December 23^d 15^h ... ... [1]

(12) Owing to vibration, during the presence of visitors in the room:
for 1884, December 27^d 15^h ... ... [1]

(13) Curve out of field:
for 1885, January 1^d 9^h ... ... [1]

(14) Iron rails and two empty carriages of the two 38-ton guns were carried back from the Colába Point Battery:
for 1886, January 21^d 8^h ... ... [2]

Occasional, through rare, failure of the bi-hourly stops to act has caused no loss of record.

85. *Treatment of monthly abstracts.*—Coefficients other than those given in the table for converting variations in inches of tabulation into m. m.—m. g.—s units of force, have been used as follows:—

For 1886 February—Coefficient adopted ·01255, being the mean (with weights 23 and 5) of the two coefficients (·01254 and ·01261) for the periods 1—23 and 24—28 February 1886.

Vertical Force Magnetograph.

86. *List of days the curves of which were rejected.*

1880, January 14 to 21.—Instrument being cleaned and re-adjusted, a new zinc temperature-compensation arm attached, magnetic moment of vertical force magnet redetermined, vertical force magnet and its attachment weighed, semicircular mirrors cleaned and enclosure exhausted.

1880, January 26, 27 and 30.—Heating experiments going on in the magnetograph room: effect of temperature changes variable and uncertain; also on 27th, instrument being re-adjusted, and air pumped out of enclosure.

1881, January 8 and 9.—Heating experiments going on in the magnetograph room; effect of temperature changes variable and uncertain.

1881, January 11.—Instrument being cleaned and re-adjusted, balancing weights on zinc temperature-compensation arm and on the magnet re-adjusted, and air pumped out of enclosure.

1881, January 24.—Instrument being re-adjusted, and air pumped out of enclosure.

1881, February 24 and 25.—Heating experiments going on in the magnetograph room: effect of temperature changes variable and uncertain.

1882, June 27 to July 10.—Instrument being cleaned and re-adjusted, several sets of deflection experiments made, and enclosure exhausted.

1883, April 16.—Instrument being re-adjusted, and air pumped out of enclosure.

1884, January 20.—Instrument being re-adjusted, and air pumped out of enclosure.

1886, January 30 and 31.—Heating experiments going on in the magnetograph room: effect of temperature changes variable and uncertain.

1886, February 1.—Instrument being cleaned and re-adjusted after heating experiments, verified weight of vertical force magnet and its attachments, and air pumped out of enclosure.

1886, February 6.—Instrument being re-adjusted, and air pumped out of enclosure.

1887, January 31 to February 2.—Instrument being cleaned and re-adjusted, magnetic moment of vertical force magnet re-determined, and air pumped out of enclosure, &c.

1887, February 11 and 12.—Instrument being re-adjusted, and air pumped out of enclosure.

1888, January 18 and 19.—Heating experiments going on in the magnetograph room: effect of temperature changes variable and uncertain.

87. *Curves very faint, but tabulated on the assumption that the tabulated values are preferable to interpolations.*

For 1879 August $9^d\ 10^h$ to 16^h and November $26^d\ 5^h$: 1880 April $24^d\ 15^h$; and July $7^d\ 11^h$ to 13^h, $8^d\ 7^h$ and 8^h, and 10^h to 12^h and $9^d\ 6^h$ and 7^h.

88. *Curve affected and corrections applied to tabulations.*

1882, July 14.—Deflection experiments made upon vertical force magnetograph; dislocation of +·102 was allowed for from 10^h to 19^h.

1882, September 8.—Deflection experiments at long distances were made upon vertical force magnetograph; dislocations due to deflector magnet were allowed for of +·002 for 20^h and of +·006 for 21^h.

1882, September 11.—Deflection experiments made upon vertical force magnetograph; dislocation of —·151 was allowed for from 10^h to 19^h.

1882, September 19.—Deflection experiments made upon vertical force magnetograph; dislocation of —·013 was allowed for from 10^h to 19^h.

1882, October 16.—Deflection experiments made upon vertical force magnetograph; dislocation of —·099 was allowed for from 10^h to 20^h.

1883, February 16.—Deflection experiments made upon vertical force magnetograph; dislocation of +·087 was allowed for from 10^h to 19^h.

1883, April 19.—Deflection experiments made upon vertical force magnetograph; dislocation of —·079 was allowed for from 10^h to 19^h.

1884, January 18 to 20.—A large dislocation occurred at about $18^d\ 10^h$, when the papers were shifted on the cylinders, causing the scale-reading to decrease to the division 22—a position of very unstable equilibrium. At about $10^h\ 45^m$ deflector was placed at an appropriate distance to increase the scale-reading to the division 34 (about) and it remained in position till about $20^d\ 12^h$; its effect seemed to grow until $18^d\ 14^h$ and then to become constant. On the 20th after $12^h\ 5^m$ the instrument was re-adjusted. The tabulation entries from $18^d\ 10^h$ to 14^h were rejected, but the missing tabulations were interpolated, and the two days from $18^d\ 10^h$ to $20^d\ 9^h$ were treated separately to obtain their diurnal variation, which was then embodied in the monthly abstract.

1884, January 21.—After re-adjustment of the instrument deflector magnet placed upon the deflection arm to keep the magnet in a convenient position: dislocations allowed for of —1·869 for 10^h and 11^h and of —·818 for 12^h.

1886, January 16.—Iron rails and two 38-ton guns, with their carriages, carried along the main road towards the Colába Point Battery; dislocation allowed for of —·016 for 7^h.

1886, February 5.—Deflection experiments made upon vertical force magnetograph; dislocation of —·100 was allowed for from 10^h to 20^h.

1886, September 21.—Deflection experiments made upon vertical force magnetograph; dislocation of —·032 was allowed for from 10^h to 19^h.

1887, February 3.—Enclosure exhausted, and vertical force magnet left on V's during exhaustion; dislocation of —·102 allowed for from 10^h to 12^h; from $3^d\ 13^h$ to 18^h, the curve being lost, the entries in abstract obtained by interpolation.

1887, February 8.—Enclosure exhausted, and vertical force magnet left on V's during exhaustion; deflector applied, causing a dislocation of +·314, which was allowed for from 10^h to 14^h; from $8^d\,15^h$ to 17^h, the curve being lost, the entries in abstract obtained by interpolation.

1887, February 18.—Deflection experiments made upon vertical force magnetograph; dislocation of +·069 was allowed for from 10^h to 18^h.

1888, May 18.—Deflection experiments made upon vertical force magnetograph; dislocation of +·031 was allowed for from 10^h to 18^h.

89. *Entries in abstracts obtained by interpolation or by substitution of eye-observations—not by direct tabulation.*

Rule of interpolation, &c.

(1) Owing to stoppage of clock:

for 1882 January $19^d\,8^h$: 1883 December $11^d\,9^h$ and $17^d\,9^h$: and 1884 April $3^d\,9^h$ ... ... [1]

for 1880 March $31^d\,20^h$ and 21^h: and 1883 December 9^d 12^h and 13^h [2]

for 1879 December 18^d 16^h: and 1884 July $26^d\,22^h$ ... ... [3]

(2) Deflection experiments going on:

for 1880 August 16^d 12^h, 13^h, 15^h and 16^h and 17^d 15^h; and September 17^d 11^h: 1881 January 10^d 20^h, 22^h and 23^h and 11^d 0^h; March 4^d 19^h and 21^h to 23^h; May $14^d\,19^h$, 21^h and 22^h and 15^d 0^h and 1^h; and August 25^d 2^h and 3^h: 1882 March $16^d\,21^h$; June $5^d\,22^h$ and $6^d\,0^h$, 3^h and 4^h; and October $19^d\,20^h$: and 1883 October $23^d\,21^h$ [1]

for 1880 January 12^d 11^h to 13^h; and April $16^d\,12^h$, 13^h and 15^h: 1882 July 14^d 20^h to $15^d\,1^h$; September $11^d\,20^h$ and $19^d\,20^h$ and 21^h; and October 16^d 21^h and 22^h: 1883 February 16^d 20^h; and April 13^d 19^h to 21^h and $19^d\,20^h$ to 22^h: 1884 January 29^d 20^h to 22^h: 1885 March 6^d 20^h and 22^h: 1886, January 29^d 21^h to 23^h; February $5^d\,21^h$ and $18^d\,20^h$ to 22^h; and September $21^d\,20^h$ to 22^h: 1887 January $29^d\,20^h$ to 22^h; February $4^d\,22^h$ to $5^d\,0^h$ and 18^d 19^h to 23^h and November $24^d\,21^h$: and 1888 May $18^d\,19^h$ to 23^h ... [2]

(3) Heating experiments going on: temperature changes variable and uncertain:

for 1880 January 26^d 7^h to 9^h ... ... [2]

(4) Owing to failure of light:

for 1883 February 28^d 20^h ... ... [1]

for 1881 January 30^d 0^h; and July 22^d 2^h ... ... [2]

(5) Clock being cleaned or taken to pieces:

for 1882 July 27^d 10^h to 18^h: 1883 December 9^d 16^h: and 1887 December $1^d\,10^h$ to 16^h ... ... [3]

(6) Influence of deflector magnet remaining at the end of the deflection experiments disappeared slowly after the removal of the magnet:

for 1882 September $11^d\,21^h$ and $19^d\,22^h$: and 1883 February 16^d 21^h [2]

(7) Owing to derangement of the axis of the recording cylinder:

for 1884 January $25^d\,21^h$ and 22^h and July $26^d\,15^h$ ... ... [2]

for 1884 February $1^d\,10^h$; and July $26^d\,14^h$ and 16^h ... ... [3]

(8) Owing to the breakage of the suspension cord of the driving weight:

for 1881 November $13^d\,9^h$: and 1887 May $31^d\,3^h$ ... ... [2]

for 1881 September $11^d\,6^h$: and 1884 July 22^d 10^h ... ... [3]

(9) Iron rails and two empty carriages of the two 38-ton guns carried back from the Colába Point Battery:

for 1886 January $21^d\,8^h$ ... ... [2]

Occasional, though rare, failure of the bi-hourly stops to act has caused no loss of record.

90. *Treatment of monthly abstracts.*—Coefficients other than those given in the table for converting variations in inches of tabulation into m. m.—m. g.—s. units of force, have been used as follows :—

	Coefficient.		Coefficient.
For 1880 January 22 ...	·0721	For 1880 January 28 ...	·0771
,, ,, ,, 23 ...	·0696	,, ,, ,, 29 ...	·0779
,, ,, ,, 24 ...	·0686	,, ,, ,, 31 ...	·0779
,, ,, ,, 25 ...	·0676		

For 1880 February ... ·0787, being the mean of the two coefficients (·0763 and ·0812) for the periods 1—15 and 16—29 February 1880.

For 1881, January 10 ...	·0477	For 1881, January 18 ...	·0411
,, ,, ,, 12 ...	·0508	,, ,, ,, 19 ...	·0399
,, ,, ,, 13 ...	·0476	,, ,, ,, 20 ...	·0397
,, ,, ,, 14 ...	·0457	,, ,, ,, 21 ...	·0389
,, ,, ,, 15 ...	·0440	,, ,, ,, 22 ...	·0384
,, ,, ,, 16 ...	·0428	,, ,, ,, 23 ...	·0376
,, ,, ,, 17 ...	·0415	,, ,, ,,25—31 ...	·0516
,, ,, February 1 ...	·0490	,, ,, Feb. 26—28 ...	·0501

For 1885, October... ... ·0329, being the mean of the two co-efficients (·0334 and ·0325) for the periods 1—16 and 17—31 October 1885.

For 1886, July ... ... ·0272, being the mean of the two coefficients (·0279 and ·0266) for the periods 1—20 and 21—31 July 1886.

Corrections for progressive change have been applied for the following periods in the respective monthly abstracts, *viz.* :—

1880 January 22, 23, 24, 25, 28, 29 and 31.

1881 January 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 and 25—31.

1881 February 1, 2—12, 13, 23 and 26—28.

1882 July 11—31.

1884 January 1—17, 18 and 19 ; and 21—31.

1886 February 2—5 and 7—28.

1887 February 3—10 and 13—28.

91. List of dislocations of the vertical force magnetograms and of the corrections applied, on account of them, to make the whole of every day's tabulations comparable amongst themselves :—

Month and Year.	Hours for which correction is applied.	Correction.	Month and Year.	Hours for which correction is applied.	Correction.	Month and Year.	Hours for which correction is applied.	Correction.
	d. h. d. h.	Inch.		d. h. d. h.	Inch.		d. h. d. h.	Inch.
1879 July ...	18 6 to 18 9	+·017	1881 March ..	20 10	+·007	1882 May ...	15 1 to 15 9	+·008
,, August ...	28 1 to 28 9	+·004	,, ,, ...	21 6 to 21 9	+·009	,, June ...	3 6 to 3 9	+·011
,, November.	6 6 to 6 9	+·014	,, April ...	1 6 to 1 9	+·004	,, July ...	14 10 to 14 15	-·029
1880 April ...	16 10 and 16 11	-·059	,, ,, ...	10 7 to 10 9	-·014	,, ,, ...	18 10 and 18 11	-·009
,, May ...	26 10	-·011	,, ,, ...	11 6 to 11 9	-·008	,, ,, ...	18 12 to 18 14	+·008
,, August ...	17 10 and 17 11	-·007	,, ,, ...	15 10 and 15 11	-·008	,, ,, ...	29 10 to 29 12	+·015
,, ,, ...	22 6 to 22 9	+·009	,, ,, ...	21 10 to 21 20	+·021	,, August ...	2 10 and 2 11	-·020
,, ,, ...	24 9	+·014	,, May ...	8 10 to 8 12	+·020	,, ,, ..	13 7 to 13 9	+·018
,, December.	5 10 and 5 11	+·006	,, ,, ...	14 10 to 14 16	-·034	,, ,, ...	17 10 to 17 16	+·043
1881 January ...	6 10 to 6 15	-·044	,, August ...	21 9	+·017	,, ,, ...	25 10 to 25 14	+·026
,, ,, ...	10 10 to 10 18	-·028	,, ,, ...	25 1 to 25 9	+·016	,, September.	3 7 to 3 9	-·016
,, ,, ...	11 7 to 11 9	-·091	,, September.	12 10 to 12 12	+·014	,, ,, ...	6 5 to 6 9	-·036
,, ,, ...	17 10 to 17 16	-·012	,, October ...	11 10 to 11 16	-·048	,, ,, ...	8 10 to 8 14	-·126
,, ,, ...	30 1 to 30 9	+·025	,, ,, ...	14 10 to 14 16	+·101	,, ,, ...	16 10 to 16 16	+·096
,, ,, ...	31 10 to 31 13	+·015	,, ,, ...	31 10 to 31 12	+·015	,, October ...	1 9	+·014
,, February .	1 10 to 1 19	-·015	,, November.	3 6 to 3 9	+·012	,, ,, ...	3 10 to 3 12	+·038
,, ,, ...	6 10 to 6 12	-·014	1882 February .	7 7 to 7 9	+·014	,, ,, ...	19 10 to 19 15	-·136
,, ,, ...	7 10	-·002	,, ,, ...	8 10 to 8 16	-·005	,, ,, ...	19 16 to 19 20	-·110
,, ,, ...	7 11 to 7 16	+·012	,, ,, ...	21 10 to 21 16	+·006	,, November.	24 10 to 24 16	+·019
,, March ...	4 10 to 4 16	-·010	,, March ...	5 10 to 5 17	+·017	,, ,, ...	28 10 to 28 14	-·015
,, ,, ...	12 9	+·022	,, April ...	19 9	-·014	,, December.	6 10 to 6 16	-·025

Month and Year.	Hours for which correction is applied.				Correction.	Month and Year.	Hours for which correction is applied.				Correction.	Month and Year.	Hours for which correction is applied.				Correction.
	d.	h.	d.	h.	Inch.		d.	h.	d.	h.	Inch.		d.	h.	d.	h.	Inch.
1882 December.	14	10	to 14	20	+ ·006	1883 December.	11	10	to 11	14	+ ·079	1885 November.	17	10	to 17	19	− ·016
,, ,, ...	15	10	to 15	16	+ ·008	,, ,, ...	11	15			+ ·021	1886 January ...	29	10	to 29	16	− ·036
,, ,, ...	20	10	to 20	12	+ ·009	,, ,, ...	17	10	to 17	18	+ ·010	,, February .	4	10	to 4	15	+ ·052
,, ,, ...	24	7	to 24	9	− ·020	1884 January ...	1	10	to 1	17	+ ·018	,, ,, ...	4	16	to 4	21	+ ·017
1883 January ...	3	10	to 3	14	+ ·010	,, ,, ...	16	10	to 16	20	− ·059	,, ,, ...	9	10	to 9	12	− ·018
,, ,, ...	29	9			+ ·030	,, ,, ...	22	10	to 22	14	+ ·017	,, ,, ...	18	10	to 18	16	− ·077
,, ,, ...	31	9			+ ·010	,, ,, ...	30	10	to 30	15	− ·015	,, March ...	23	10	to 23	16	+ ·068
,, February .	4	3	to 4	9	+ ·009	,, February .	1	10			+ ·007	,, April ...	20	10	to 20	19	+ ·022
,, ,, ...	4	10	to 4	12	+ ·010	,, ,, ...	27	10	to 27	16	− ·020	,, ,, ...	20	20			+ ·010
,, ,, ...	9	10	to 9	18	− ·017	,, ,, ...	27	17	to 27	20	− ·030	,, May ...	14	0	to 14	9	+ ·026
,, ,, ...	16	10	to 16	16	− ·070	,, March ...	26	10	to 26	16	− ·042	,, ,, ...	17	10	to 17	20	+ ·026
,, ,, ...	17	10	to 17	15	+ ·094	,, ,, ...	26	17	to 26	20	− ·031	,, June ...	4	10	to 4	15	− ·011
,, ,, ...	23	23	to 24	9	+ ·009	,, April ...	26	10	to 26	15	+ ·046	,, ,, ...	8	10			+ ·014
,, ,, ...	28	10	to 28	16	− ·063	,, May ...	22	10	to 22	20	− ·008	,, ,, ...	26	10	to 26	18	− ·023
,, March ...	12	10	to 12	16	− ·018	,, ,, ...	29	10	to 29	16	+ ·009	,, July ...	20	10	to 20	20	+ ·012
,, ,, ...	13	10	to 13	12	− ·012	,, June ...	1	9			+ ·019	,, August ...	3	10			+ ·026
,, ,, ...	16	10	to 16	16	− ·059	,, ,, ...	18	10	to 18	16	− ·010	,, October ...	22	10	to 22	21	− ·063
,, ,, ...	16	17	to 16	20	+ ·014	,, ,, ...	18	17	to 18	21	− ·032	,, November.	19	10	to 19	16	+ ·059
,, ,, ...	18	7	to 18	9	− ·015	,, July ...	21	17	to 21	20	+ ·036	,, ,, ...	19	17	to 19	21	+ ·040
,, ,, ...	22	10			+ ·159	,, August ...	24	10			+ ·037	,, December.	20	10	to 20	16	− ·013
,, ,, ...	22	10	to 22	16	+ ·103	,, October ...	7	10	to 7	17	− ·030	,, ,, ...	20	17	to 20	21	− ·005
,, April ...	7	10	to 7	16	− ·070	,, ,, ...	12	10	to 12	16	+ ·029	1887 January ...	29	10	to 29	16	+ ·078
,, May ...	18	10	to 18	20	+ ·026	,, November.	17	10	to 17	16	+ ·038	,, April ...	25	10	to 25	16	+ ·092
,, June ...	15	10	to 15	20	+ ·018	,, ,, ...	17	17	to 17	20	+ ·022	,, May ...	20	10	to 20	16	+ ·004
,, ,, ...	27	10	to 27	16	+ ·023	,, December.	15	10	to 15	20	+ ·055	,, July ...	19	10	to 19	16	+ ·010
,, July ...	12	10	to 12	12	− ·042	1885 January ...	19	10	to 19	26	+ ·066	,, October ...	19	10	to 19	16	− ·014
,, ,, ...	18	10	to 18	19	+ ·065	,, ,, ...	19	17	to 19	20	+ ·005	,, ,, ...	25	6	to 25	9	+ ·013
,, ,, ...	18	20	and 18	21	− ·012	,, February .	19	10	to 19	19	+ ·034	1888 March ...	17	10	to 17	17	− ·031
,, August ...	15	10	to 15	20	− ·008	,, March ...	6	23	to 7	9	+ ·019	,, ,, ...	21	10	to 21	17	− ·005
,, October ...	23	10	to 23	16	+ ·165	,, April ...	14	10	to 14	21	+ ·020	,, June ...	22	10	and 22	11	+ ·020
,, ,, ...	23	17	to 23	21	+ ·143	,, July ...	21	10	to 21	20	+ ·032	,, July ...	30	10	to 30	16	+ ·027
,, November.	15	10	to 15	16	+ ·031	,, August ..	18	10	to 18	26	+ ·026	,, September.	18	10	to 18	19	− ·011
,, ,, ...	25	5	to 25	9	− ·076	,, September.	1	7	to 1	9	− ·014	,, October	17	10	to 17	18	+ ·016
,, December.	5	5	to 5	9	− ·019	,, ,, ...	19	0	to 19	9	− ·098						

Dislocations that occurred between $9^h\ 17^m$ and $10^h\ 17^m$ are not entered in this list, because they do not affect the comparability of the compelete day's tabulations.

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